SCIENTIFIC AMERICAN

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NEW YORK, NOVEMBER 5, 1904

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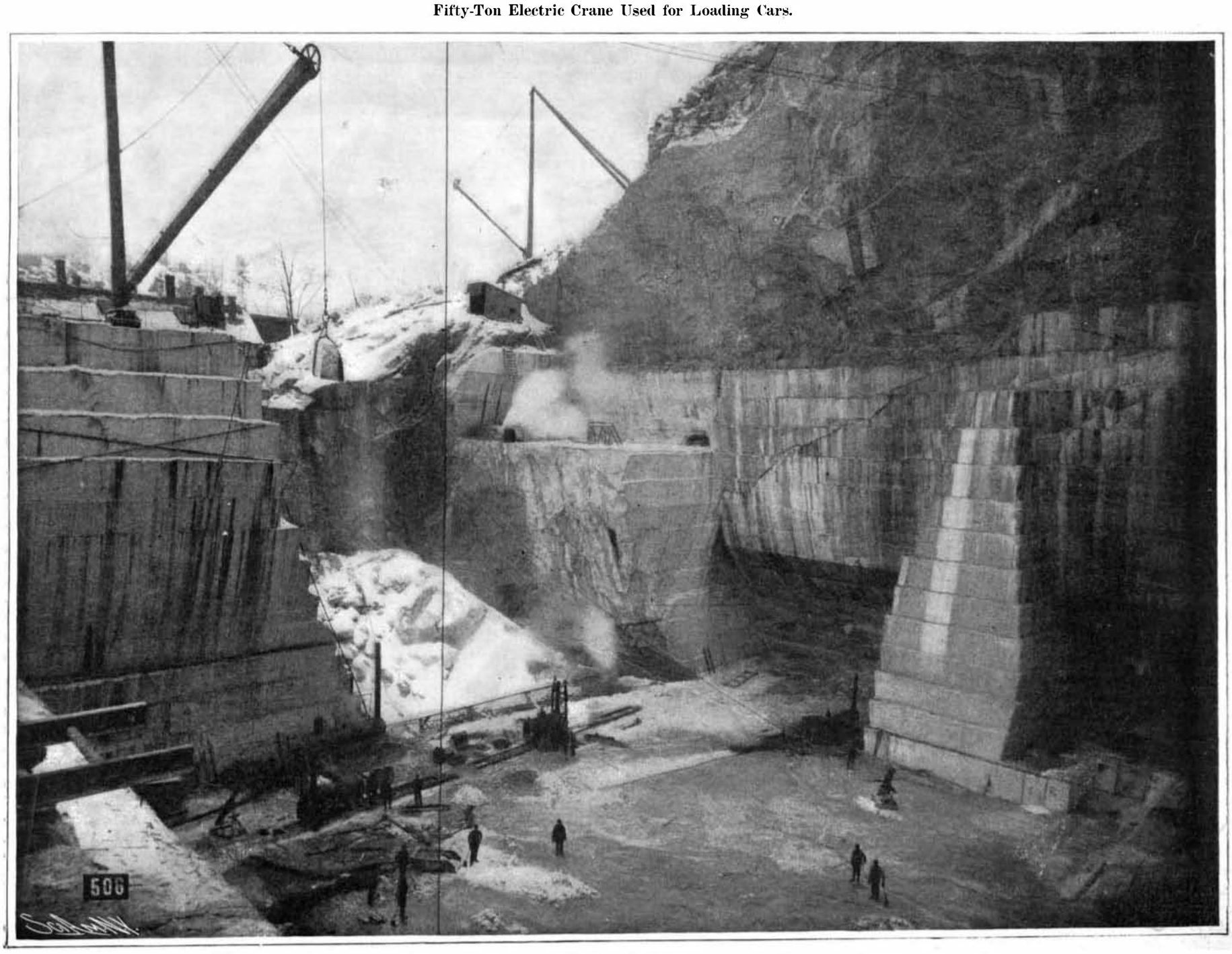
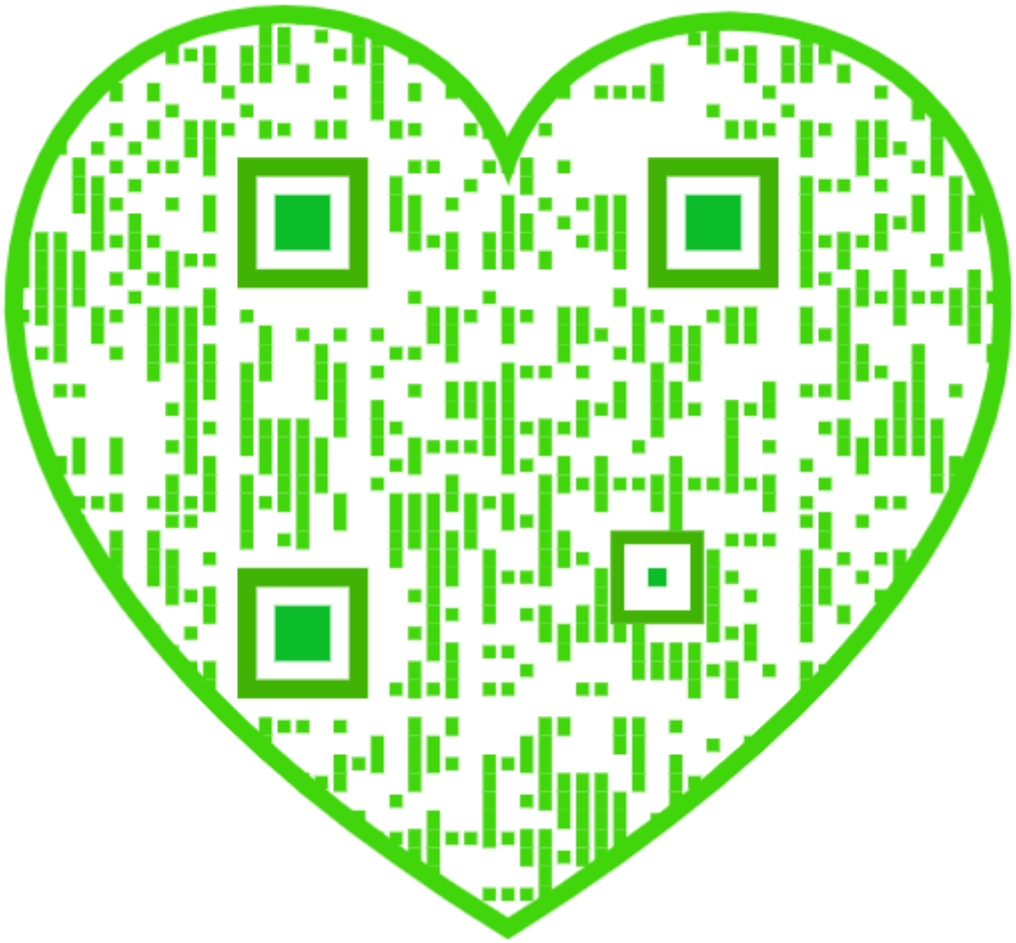
Fifty-Ton Electric Crane Used for Loading Cars.



View of Quarry, Showing the Method of Supporting the Sides by Leaving Buttresses of Marble in the Cut.

THE CARRARA OF AMERICA.—[See page 317.]



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NEW YORK, SATURDAY, NOVEMBER 5, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE SHOCKING DISFIGUREMENT OF THE SUBWAY.

The first impression of American visitors to the city of London is one of astonishment that in a municipality in most respects so well governed, such free rein should be given to the advertising bill poster. Cars, busses, and above all the station walls of underground railways, are so plastered with hideous advertisements that the metropolis of the world looks to the eye of an American like one big blistered abomination.

During the building of our splendid Subway it was a matter of frequent congratulation that the Rapid Transit Commissioners and their engineers had given such a large share of their attention to the question of its artistic appearance. The various photographs that were published in our journal during the construction of the road, showing the station interiors, were the subject of much favorable comment, and in the two or three weeks preceding the opening of the Subway, the citizens who, by virtue of their passes, had an opportunity to inspect the system and ride upon the cars, were unanimous in their praise of the simplicity, chaste beauty and hygienic excellence of the glazed tiling in which the station walls are finished.

No sooner, however, had the road passed into the hands of the operating company than every station was invaded by an army of bill posters, who proceeded to distribute along the walls of the station from end to end, a lot of miserable gilded tin frames, each containing a specimen of the lurid color work in which the bill poster delights. We have no quarrel whatever with this last-named gentleman; he has his place and a very useful one in the economy of modern life, but never, we think, did his zeal carry him so utterly outside of his lawful province as when, "rushing in where angels fear to tread," he transformed every one of the artistic walls of our Subway stations from a thing of beauty into the cheapest kind of billboarding.

Judged from the sanitary point of view the introduction of these tin signs is about the worst thing that the Interborough Company could have done. There is a natural prejudice on the part of a people as fond of fresh air as are the citizens of New York, against underground travel as such. In the early days of the struggle of the principle of Subway construction for recognition, the writer, who was ever an earnest advocate of the new road, found that this objection was very widespread, and even at the present time there are many people who have yet to be taught that the air of the Subway and its general hygienic condition are not unhealthful. The germs of disease love dark corners and a damp atmosphere, and it was largely because the Rapid Transit Commissioners recognized the necessity of building the station platforms and designing the station fittings with a view to securing good hygienic conditions, that they decided to use tiling for the walls, and to make these walls as plain and free from projecting ornamentation as possible, so that dust and dirt, those great harborers of disease germs, might have as little place of lodgment as possible. They even carried the principle so far as to abolish the sharp corners where the walls meet the platform, the tiling at the base of the walls being rounded off into the platform so as to admit of easy cleaning.

In view of these facts, we cannot conceive of any means by which the Interborough Company could have so effectually undone the sanitary work of the engineers as by leaning these miserable tin pictures, with their moldings and angles and corners, against the walls, thereby covering up the corners, and providing an excellent nesting place for dust, dirt, and disease.

As to the effect of this display upon the artistic paneling and dainty colors of the walls, it is hideous. The simple dignity of the architectural and engineering features of the stations is destroyed at once, and the platform spaces look like a tenement house moving, before the pictures have been hung.

Surely this magnificent city of ours bears sufficient evidence of the blighting effect of purely utilitarian and mercenary tendencies as against considerations of good taste and artistic sentiment, without this last and most splendid of its engineering achievements being so pitifully belittled and cheapened.

The burden of the public indignation which is being felt at this desecration is entirely upon the shoulders of the Interborough Company, for the public will not be surprised to learn that, when the question of advertising was mooted, the Rapid Transit Commissioners, and the Chief Engineer and Counsel of that body, protested bitterly against the very thing that has happened. Of course, the tin pictures are there because "there is money in it"; yet we cannot but think that upon mature consideration the Interborough Company will feel that the hundred thousand dollars or so a year of revenue derived is after all a most pitiful return, in view of the degradation to which this great municipal work has been subjected in the very hour of its inauguration.

RAPID ACCELERATION OF THE SUBWAY TRAINS.

The average speed of the express trains on the new Subway will, for the present, be about 25 miles, and of local trains 18 an hour, including stops, and the maximum speed of expresses between stops will be 45 miles per hour. The average speed of local and express trains will exceed the speed made by the trains on any elevated railroad. Now the only way in which such a high average speed as this can be maintained is by providing a very rapid acceleration of the train in starting, and, of course, a rapid retardation in stopping. The powerful motor equipment provided is capable of accelerating the trains, when they are loaded to their maximum capacity, at the rate of 1.25 miles per hour per second in starting from stations on level track. It is stated by Mr. L. B. Stillwell, who is responsible for the whole of the electrical equipment of the Subway, that to obtain the same acceleration, if the road were operated by steam or electric locomotives, would require a drawbar pull of 44,000 pounds, which is equal to the maximum effect of six of the steam locomotives that were used on the Manhattan Elevated Railway. To secure the same acceleration with standard-gage passenger locomotives would require two of the latest Pennsylvania Railroad type, which latter would weigh together about 250 net tons. In the Subway express trains of eight cars, the necessary tractive effort is secured by equipping five of the cars with two 200-horse-power motors apiece, and the total addition thus made to the weight of the train aggregates only 55 net tons. Evidently, then, if the work had been done by locomotive, it would have been necessary to employ a lower rate of acceleration for express trains. This could have been done without sacrificing the average speed by using a higher maximum speed between the express stations, the average distance between which is approximately two miles. In the case of local trains, which average nearly three stops to the mile, no considerable reduction could be made in the rate of acceleration without materially reducing the average speed. The increase in the weight of local trains, due to the motors, is 33 net tons, and to obtain the necessary adhesion and acceleration, if locomotives were used, would require a load of eighty net tons upon the driving wheels. This comparison serves to illustrate very forcibly the advantages of the multiple-unit system of electrical control under which the Subway trains are run.

SCALE DIVISIONS AND ERRORS OF GRADUATION.

In a paper recently presented to the Académie des Sciences, M. G. Bigourdan, an eminent astronomer of Paris, brings out some new points relating to the graduated scales of different measuring instruments, and the errors which may be due to the same. In the high class instruments, the division of the graduated scales is generally made upon silver. This metal gives a clear cut by the point of the graduating machine and thus furnishes permanent lines which can be set with great exactness. But as the metal is expensive the circle cannot be made entirely of silver, and a cheaper metal is used for the support, into which a thin plate of silver is inserted. Brass or bronze has been generally used as the supporting metal, but for the larger astronomical instruments cast iron has been used for a long time past, in spite of the fact that it is not very homogeneous. The divided circles all have errors of division and these are determined very carefully with the instruments of the observatory. Generally a number of operations are carried out so that by averaging the results the error of each line of the scale is known very closely, and afterward it is supposed that these errors remain always the same. However, if the errors are determined again after a number of years, the results which are found sometimes differ from the former in a considerable proportion, and we must come to the conclusion that the hypothesis of permanent errors of division is not verified by experience. M. Bigourdan considers that this variation is due simply to the influence of temperature changes, even independently of the non-homogeneity of the support. If we consider a circle formed of a solid cast-iron framework at the periphery of which a silver band is incrusted, this band, which is thin and malleable, is evidently obliged to follow the temperature variations of the cast iron. The expansions of iron and silver, expressed in microns, are 20 μ and 11 μ per meter and per degree C. respectively, making a difference of 9 μ. As to the greatest variation of temperature during the year, it exceeds 40 deg. C. in this climate. In a circular scale of 1 meter diameter, for instance, the difference of expansion of the silver band with relation to the iron would reach during the year the value $9\ \mu \times \pi \times 40$, or 1.13 millimeter. This is the elongation or contraction of the band in passing from one season to the other. For the errors of division to remain permanent, each point of the band should be displaced in the same radius, but this condition is only obtained exceptionally, seeing that the two kinds of matter which react upon each other are not perfectly homogeneous, and because the silver band cannot be fixed at all points alike. In the circle in question of 1 meter diameter, the angle of 1 dec. corresponds to an arc of 2.43 $\pm$ length. At the supposed degree of approximation, μ 0.1 dec., the errors of division will only remain invariable if the lateral displacements have been below 0.24 μ, which quantity is about equal to 1-5000 of the total change of length. In the case of brass or bronze supports these difficulties are nearly all suppressed, as the expansion coefficient of these alloys is scarcely below that of silver. Cast iron should therefore be rejected as a supporting material, and brass or bronze preferred. But it is still better to make the circles of a single metal which should be cheap and not easily tarnished, capable of a good polish and of giving a fine line in the tracing machine. These conditions seem to be fulfilled by nickel and certain kinds of nickel-steel.

A NEW METHOD OF OBSERVING THE N-RAYS.

In a paper recently read before the Academie des Sciences, M. Blondlot indicates a new method of observing the effect of the N-rays. It is easier than the previous methods, and does not fatigue the eye. It indicates the N-rays or the new heavy emanation which M. Blondlot has recently discovered. A difference in brightness of a spark or flame is not used here; but it is only required to see the appearance and disappearance of a luminous line upon a background lighted by a complementary color. To carry out the experiment, a streak of calcium sulphide paint is brushed upon a piece of rough grained white cardboard. It forms a line 0.004 or 0.01 inch wide and 1.5 inch long. The sulphide is insulated and then taken to a dark room. The latter is provided with a dark-lantern containing a gas-burner. It has an opening in one side which is covered by an orange-yellow glass. The lantern is placed at 6 or 8 feet from the cardboard, and thus gives it a yellowish light. The flame is turned up or down during the experiments to regulate the light on the screen. At first the flame is made very small and the blue phosphorescent line of sulphide is observed on the yellow ground of the cardboard. By slowly turning up the flame a point is reached where the sulphide becomes quite invisible upon the yellow background. This point is reached when the orange-colored light, which is reflected by the sulphide, combined with the blue rays which it gives off by phosphorescence, form a tint which is almost white. This tone gives practically no contrast with the yellow background and is hence invisible. After carefully regulating the burner until the sulphide line disappears, the experimenter holds his head perfectly still and the N-rays are thrown upon the sulphide. Now the blue tint re-appears. When the N-rays are thrown off, the streak disappears again. Care should be taken to avoid making an undue effort of vision, which might give rise to physiological and even physical effects. Just as Helmholtz remarked that the ear needs to be educated in order to separate a sound into its different component sounds, so in this case we need to adapt our organs to a special kind of work which is quite different from the ordinary.

The success of the experiment of introducing the Guatemala ant to combat the cotton-boll weevil, which has been undertaken by the United States government, was threatened by an effort to have the courts interfere. A large Texan plantation owner named Ross took the matter into court, to have Dr. Cook enjoined from bringing these ants into this country, on the ground that they would in all likelihood become a greater nuisance and a more serious menace than the weevil. He claimed that the ant was very ferocious, and would make it so disagreeable for the cotton pickers that it would be difficult to get them to go into the fields. The court refused to entertain this view of the matter, and declined to grant the injunction asked for.

THE PERSONALITIES OF PROFESSOR AND MADAME CURIE.

BY DANIEL BELLET.

The attention of the entire scientific world is at present directed to the grand discovery of radium and the immense domain that seems to be opening up to science from the detection of those mysterious radiations which, according to M. Curie, we may now expect to find in almost all substances, but doubtless to a much less extent than in radium. The two physicists to whom we are indebted for the discovery are attracting the notice of every one, and the more so in that they afford an example of a most interesting and touching collaboration, since it concerns a husband and wife, both of high scientific attainments, who aided one another with their efforts and knowledge in the arduous path that finally led to the production of pure radium, and the discovery of the phenomena that are now engrossing the minds of most of the physicists of the world.

Under such circumstances, it may prove of interest if we give a few details of the life of these two coadjutors, of their past, and of the manner in which they came to associate their existences, each finding in the other that love of science that forms the basis of all their labors. Let us say at the outset that what dominates the personality of these scientists is a modesty and simplicity that would amaze any one who should pay them a visit in the simple little house that they occupy in the outskirts of Paris.

Since M. Curie's name figures so prominently in all high-class scientific publications as well as in the daily press, we might expect on a visit to him to be confronted by a man alive to the importance of his labors and showing a very natural pride in the distinction conferred upon him by the award of one of the Nobel prizes, after that which had already been accorded him by the French Academy of Sciences. But, on the contrary, the man who receives us is a bashful individual who seems to be actually astonished that any one should take the trouble to come to visit him in the somewhat obscure quarter in which he dwells. This is along the fortifications of Paris, upon a boulevard which is traversed by but few pedestrians, and upon which carriages are very rarely seen, and very far back of the Observatory. The house has but a single story above the ground floor with only three windows in it. We are received in a very plainly furnished parlor, and perceive that the two occupants of the house live exclusively for science and attach but slight importance to material enjoyments, at least at present; for although one of them is a functionary of the State and the other of the city, they receive but quite a small salary, since even the most learned professors are not usually paid much in France.

Mme. Curie and her husband are two workers who have traveled life's pathway in toiling with untiring energy; and if we look backward at their career we shall perceive at every point of it that perseverance in labor which was to lead them to the renown that they now enjoy.

M. Curie is a Parisian and the son of a physician, and for this reason evidently he must early have had instilled into him a love for science; for physicians constitute a class of people in France who are distinguished by the breadth of their views and their learning. M. Curie was born in 1859, and is consequently about forty-five years old.

After M. Curie had finished his preparatory studies, he immediately began scientific researches on his own account. He states that his personal labors were begun in 1879, when he was twenty, while ordinarily a young man of that age has neither the maturity nor volition to do anything but learn. In stating this fact to me, M. Curie preserved his modest and somewhat timid demeanor, just as he did when he said to me that he had really "not many scientific titles," but was merely a licentiate and doctor of sciences.

M. Curie remained *chef de travaux* until 1895, when he was made professor of physics. But the man who had begun to make original scientific researches while he was but a simple preparator at the Sorbonne lost none of his ability.

In 1895 M. Curie was made professor of physics and chemistry, the epoch at which he met her who was to be to him not only a companion, but a valuable coadjutor, and whose personal work was even to lead M. Curie to partially abandon his researches and enter upon a new path.

Mme. Curie is a Pole. Marie Sklodowska was born at Warsaw in November, 1868, and is therefore a very young woman. She has a sweet and intelligent face, which has not become forbidding through the dryness of scientific things. It must be said, indeed, that she is not only of a race, but of a family in which science and learning prove forbidding to none. Her father, Ladislas Sklodowska, was a professor and at the same time an excellent naturalist, while her mother, Bronistawa Boguska, was principal of a boarding-school. Mme. Curie, moreover, has a sister who married Doctor of Medicine Dlurski, and who is herself a physician. The two conduct a sanitarium at Zakopane in Galicia; and here again we find a scientific collaboration between husband and wife. Marie Sklodowska exhibited, even in her girlhood, a high order of intelligence, keen perceptive faculties, and a great capacity for work. She completed her ordinary studies at the age of sixteen at the gymnasium or lyceum for young ladies at Warsaw, and upon her graduation received a gold medal. At the outset, she had to live in the country, a circumstance that necessarily interfered with her studies; but afterward she went to live at Warsaw, and there found time to work in the laboratory of physics of the Industrial Museum, which was presided over by one of her relatives. Finally, in 1891, she went to Paris, where she took but two years to obtain a first licentiate's degree in the mathematical sciences. She did not yet feel satisfied, however, and two years later on, took a degree in the physical and chemical sciences. M. Pierre Curie, finding himself in the presence of a charming young girl in whom he met with the same love for science and the same inclination for study that he himself possessed, soon became smitten with her and finally married her.

PROFESSOR AND MADAME CURIE.

It will be seen that two workers of this kind were made for a thorough understanding of each other and for an intimate collaboration. Mme. Curie had become professor of physics at the High School of Sevres, where her researches upon radium were the subject of a thesis that obtained for her the title of Doctor of Sciences. Very naturally, the presentation of memoirs to the Academy of Sciences and the publication of papers in scientific journals became more and more frequent under the name of Curie that we have had to mention so often, although in most cases the name included that of Mme. Curie. It is impossible for us to follow step by step the researches made by the two scientists in the laboratory of the School of Physics and Chemistry. In the first place, Mme. Curie entered the path marked out by her husband, and we may mention especially a memoir by her upon the magnetic properties of steel of known composition tempered under determinate conditions. But, owing to a study upon the conductivity of air under the influence of the rays of uranium and thorium, she was led into the domain in which she and her husband were to make most important discoveries, and after that occupied herself particularly with the rays emitted by the compounds of these two metals. Finally, toward the end of 1898, the Academy of Sciences received a communication that may be considered as marking an epoch, and in which M. and Mme. Curie positively confirmed what they had already announced as to a new and strongly radio-active substance contained in pitch-blende. In the first place they found a new element to which they gave the name of polonium, evidently in remembrance of the country of Marie Sklodowska, and afterward discovered another element having the chemical appearance of nearly pure barium, but nevertheless very different therefrom. This was radium, the well-named substance that was to revolutionize modern chemistry. Following this success, the communications of the two scientists began to multiply, all of them relating more or less to this very surprising substance and its diverse properties. They showed especially that the rays emitted by polonium and radium are capable of communicating radio-activity to naturally inactive substances, a fact that led M. Becquerel, whose labors had prepared the way for those of the Curies, to demonstrate the importance of the new discovery. We ought not really to separate the name of M. Becquerel from that of the two scientists under consideration. M. Curie, however, has more particularly investigated the action of the magnetic field upon the Becquerel rays, a subject that belongs to the domain of his favorite studies.

The great importance of the discovery under consideration was appreciated as far back as 1901, when the Academy of Sciences awarded the La Caze prize of 10,000 francs to M. Pierre Curie, while associating with his name that of his wife. A short time afterward, Mme. Curie put chemistry in possession of a relatively large quantity of radium, she having, by very troublesome fractional crystallizations, obtained a decigramme of perfectly pure chloride, which allowed her finally to determine the atomic weight of this body. A little later on, M. Curie, aided by M. Laborde, made some very curious observations upon the heat continually disengaged by the salts of radium.

M. and Mme. Curie are certainly not going to stop here, especially now that a chair has been created for M. Curie at the Faculty of Sciences. Since they have succeeded in ascertaining the very nature of the radiation emitted by radium, they will evidently endeavor to solve the second part of the problem—the cause of such mysterious radiation. At present they have no definite opinion, and it will be the great interest of their coming researches to ascertain finally whether the energy discharged by radio-active bodies is created in themselves or is borrowed from external sources.

BENBOW'S AIRSHIP FLIGHT.

Benbow's airship made what is considered a successful trial at the World's Fair on October 27. Benbow's airship weighs about 600 pounds without an operator. The gas bag is seventy-five feet long and about twenty feet wide at the center, tapering at the ends. The bag contains 16,000 cubic feet of gas when inflated, and on this gas the ship depends for maintenance of equilibrium. The frame of the ship is of aluminium and wood, and the power is derived from a ten-horse-power gasoline motor.

Momentum is given to the airship by means of two large side wheels, or fans, each consisting of four blades, so constructed that they automatically fold after completing the stroke against the air, and do not expand until again in position to force the airship ahead.

ONE HUNDRED AND FIFTY MILES AN HOUR ON ELECTRIC ROAD.

It is expected to reach a speed of 150 miles an hour in the new tests which will be made on the high-speed electric line near Berlin. It will be remembered that the last experiments which were made on the specially-laid track from Berlin (Marienfeld) to Zossen resulted in a speed of over 130 miles an hour. It is now proposed to increase this speed, according to recent reports. It appears that the project which has been laid before the Prussian Minister of Public Works for constructing a high-speed electric line between Berlin and Hamburg is not considered as sufficiently practical in the present state of experience. The authorities do not wish to allow such a road to be built without making a further series of trials on a smaller scale. Accordingly it is proposed to carry on a new set of experiments on the Berlin-Zossen line and if all is satisfactory to the authorities they will grant the concession for the Hamburg road. It is expected to begin the tests within a few months, but as the designers have already profited by their previous experience they expect to increase the speed of the electric trains considerably and run them as high as 150 miles an hour.

THE VERANT: A NEW DEVICE FOR VIEWING PHOTOGRAPHS.

BY EMILE GUARINI.

The verant is an instrument designed for the monocular examination of photographs obtained with ob-

THE "VERANT" IN USE.

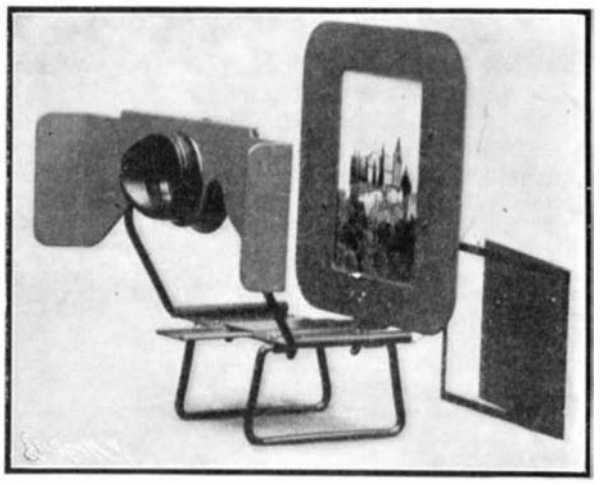
jectives of short focus. When a view has been taken with an objective of which the focal distance is appreciably less than the distance of distinct vision, that is to say, 10 inches, a long-sighted observer cannot place his eye near enough to the photograph to see the images that it represents, at the same angle at which his eye would have seen the objects themselves had it occupied the place of the objective at the moment at which the exposure was made. A uniformity of such angles might be obtained, it is true, by enlarging the first photograph; but this process, which is quite a long and troublesome one, would have the inconvenience of bringing the eye too close to the images of very distant objects (such as landscapes and buildings). The verant obviates these difficulties by furnishing a very distant visual image of the photograph, the various parts of which are shown to the eye at the same angles as those at which the objects photographed appeared to the lens of the camera. This result is obtained by means of the new achromatic lens mentioned above, which possesses the two following advantages: its focus is, with sufficient approximation, equal to that of the objective with which the view was taken, and it produces no distortion at a point situated at about an inch from the nearest lens, so that the center of rotation of the eye can be brought to this point.

The apparatus is mounted upon a special frame that permits of bringing the photograph into position at the desired distance. The base plate is provided with a handle formed of two stirrup irons that can also be used as a support when the apparatus is employed in an elevated position. Such a position is to be recommended when it is desired to examine a large number of photographs. Upon the upper part of the plate there is a slide for focusing the image, and two bent rods for the reception of the screen that carries the lens, and which can be folded up. The screen is wide, and its two sides are curved toward the observer in order to protect the unused eye from the light as far as possible. Its surface is dark and unpolished. The screen engages with the two rods by means of two spring sockets. The axis of the lens is at right angles with the center of the image when the screen is pushed back upon the rods, so that the latter touch the upper edge of the screen. The lenses are constructed in two sizes, one of them having a focus of 4.25 and the other of 5.8 inches. When the eye is well placed, these two lenses furnish an anastigmatic, achromatic image free from distortion. According to experiments, a deviation of about 15 per cent between the focus of the objective with which the view was taken and the focus of the lens of the verant is nearly imperceptible to the eye. The lens of 4.25-inch focus can consequently be used for all views taken with objectives whose foci are comprised between 3.5 and 5 inches, and that of 5.8-inch focus for views taken with objectives having a focus comprised between 5 and 6.5 inches. It is sometimes of interest, however, to use a lens of shorter focus than that required by the rule just mentioned. Although less correct, the image furnished by such a lens may prove more agreeable to the eye. The verant diminishes the importance of the foreground, and, in certain cases, an exaggerated diminution of this part of the view gives more harmonious effects.

In addition to the views, it is possible to fix in the frame a ground glass for use in examining transparencies, or a small sheet iron frame designed for unmounted views. This frame is arranged like film supports. It is constructed for 3.5 x 4.6-inch sizes, and can, at will, be shoved up or down upon the bent extremity of the rods. It is provided upon the back with a slide for the reception of the views.

In making use of the apparatus, an observer having normal eyesight sees, not the small photograph introduced into the instrument, but its distant image, and, owing to the fulfillment of the conditions enumerated above, this image is seen free from distortion, and, except for color, with exactly the aspect that the scene photographed had at the place at which the view was taken. The apparent size, the shadows, and the sharpness are faithfully rendered. The result is an impression of reality that leads the observer to a correct appreciation of the distances. He sees the photograph with its natural relief. It is necessary, however, to select the eye with which it is desired to observe, and to carefully manipulate the screen. This latter is so constructed as to assure the eye the desired position at about an inch from the surface of the lens. It must be applied closely against the eye, so that its higher part shall cover the external angle of the latter. Internally, it carries a holder, designed to receive the correcting glasses for far or near sighted persons.

After the eye has been selected, it is necessary to turn the elevated part of the screen toward the left if it be desired to make use of the left eye, and toward the right if it is the right eye that is to observe. After this, the four fingers of the left hand are inserted in the handle. Then the apparatus is placed as near as possible to the eye that is to observe, and the focusing is effected by pressing the extremity of the slide with the thumb of the hand that holds the apparatus. The operator stops when the view appears with sharpness throughout its entire extent. If one angle or one side of the view is not sharp, the center of rotation of the eye is not upon the axis of the lens, and the head must there-



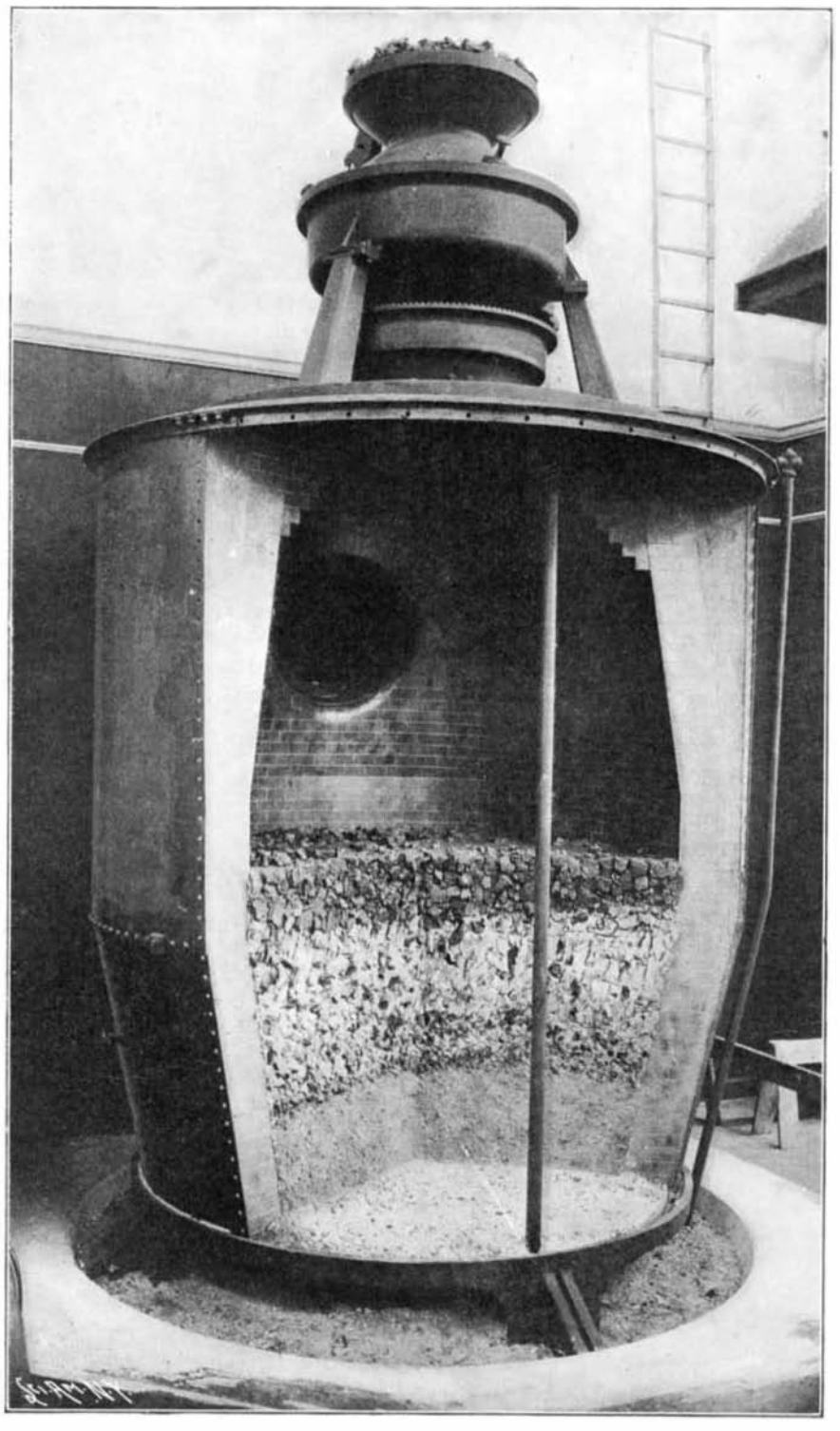
THE "VERANT."

fore be slightly moved, and, if that does not suffice, the direction of the screen must be changed.

Long and short sighted persons should, before using the apparatus, remove the screen and introduce a correcting glass into the holder intended for it. It is unnecessary to say that, under such circumstances, the lens of the verant will present the usual distortion of spectacle glasses which, however, the majority of those who wear glasses will not notice. Individuals having abnormal eyesight can also remove the screen and bring the verant as close as possible to the glasses that they use for seeing at a distance. But this method of operating has the inconvenience of not fixing the position of the eye, even approximately, and often furnishes defective images to observers who are not familiar with optical instruments. During the observation, it is necessary to give the axis of the apparatus, as nearly as possible, the same inclination upon the horizon as the objective had during the exposure. The apparatus should therefore, as a general thing, be held horizontally. This method of operating contributes toward producing an impression of reality. Upon properly inclining the apparatus, it is sometimes possible to correct the convergence of the lines of a building photographed with a camera which was not held level, but was pointed upward.

The photographs mounted upon cardboard are introduced into the frame in exactly the same way as lantern slides into a stereopticon. With unmounted views, the small sheet-iron frame is used. When the arrangement is not provided with a ground glass, one is fastened upon the back faces of the frame.

Being free from distortions and astigmatism for an apparent field exceeding 50 per cent, it is unnecessary to say that the new verant lenses are capable of being used with advantage as weak lenses or as lenses for reading. The manufacturers have even mounted some of them in appropriate frames. They are provided with an asymmetrical screen which assures the center of rotation of the eye the desired position at about an inch from the neighboring surface of the lens. Short-sighted persons must naturally here also introduce a correcting glass into the holder at the back of the screen.



MODEL OF A CONTINUOUS-FEED GAS PRODUCER AT THE ST. LOUIS FAIR.

MODEL OF A CONTINUOUS-FEED GAS PRODUCER AT THE ST. LOUIS FAIR.

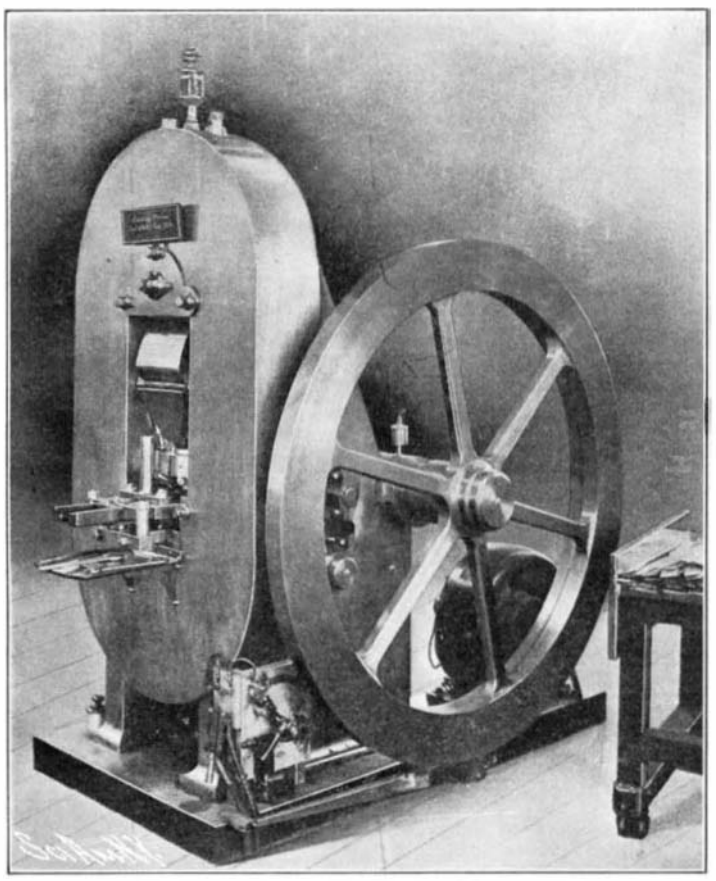
The construction of the Morgan producer herewith illustrated, which is exhibited in the Mines and Metallurgy Building at the St. Louis Fair, is exceedingly simple. It consists essentially of a firebrick-lined shell supported on standards in a basin of water. The lower part of the shell, which is without a bottom, is filled for about two or three feet with ashes, which stand in the water and can be easily dug away from the periphery of the basin. Upon this bed of ashes is supported a layer of coal of about the same thickness, which is maintained in the incandescent state by a blast of air driven by a Korting blower with steam jet to a point just below the

(*Continued on page 314.*)

THE UNITED STATES MINT AT THE ST. LOUIS EXPOSITION.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The most popular section of the exhibit of the United States Treasury Department in the Government Building at St. Louis is an exhibit by the United States Mint of the complete process of coining money. This includes every step, from the melting of the metal to the coining of the money, and a touch of rare historical interest is given to the display by placing in close juxtaposition to the most modern coining press a fine old relic in the shape of the first press used in the United States Mint. The old press, which is an exceedingly crude affair of wood and iron, was probably used only for the stamping of small coins. The hammer and the small scale which were used for assaying purposes, that are seen on the machine, are known to be of the same date as the press. The die rests in the bottom on the wooden frame, and the centering was done by four side screws. The upper die was placed in the center at the bottom of a screw with a very rapid thread, which was operated by a long cross-bar, as shown in the engraving. The lower die was then centered by means of the four screws to match the upper die. A remarkable fact about the old relic is that it has been continuously in use up to January last in the making of cupels. The machine was hand-fed and, of course, its capacity was very limited. The new machine, shown adjacent to it, forms part of the modern plant comprising the exhibit. It runs at a speed of ninety revolutions per minute, and has a capacity of ninety large pieces of money in the same time. The blanks to be coined are placed in the vertical cylinder seen just in front of the dies, and the pieces are taken out from the bottom by automatic metallic fingers, which place them forward on the die, ready to receive the impression. The smaller-sized presses, which are used for ten-cent pieces, have a capacity of 120 impressions per minute. The machine is run by the small motor, which will be noticed bolted to the foundation to the rear of the flywheel. The switch and controller are located in the front of the machine conveniently to the operator.



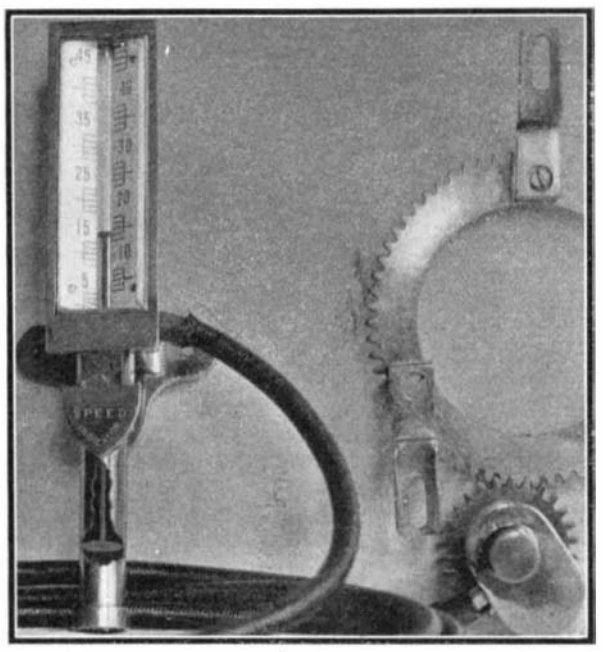
MODERN UNITED STATES COINING PRESS.

The first operation, that of melting, is carried on in a furnace fired by naphtha gas. The charge of 90 per cent of gold and 10 per cent of copper, or 90 per cent of silver and 10 per cent of copper, as the case may be, is placed in a plumbago crucible, and melted in about an hour and a half. It is cast into cast-iron molds containing two ingots in each. Samples are meanwhile taken to the Assay Office, and if the report is favorable, the metal is passed on to the Coining Department. The ingots, which measure one-half inch in thickness by an inch and a half in width, are then given fifteen passes through the rolls, until they are reduced to the desired thickness for the coin; this, in the case of a $20 gold piece, is 83/1000 of an inch. This process of annealing is a very important one, and has to be carefully watched; and it should be noted that the metal is rolled down to weight and not to thickness. The process is continuous, the strips of metal being fed slowly through a furnace in which the temperature is about 1,000 degrees Fah. As they emerge from the furnace, the strips are cooled by a spray of water. It is an interesting fact that the composition of the metal is such, that the spraying does not have any hardening effect upon it. The metal strips are now taken back for a final rolling, which is done under a comparatively light pressure. Then the strips are carried to the punching machine, where the blanks are punched out at the rate of 200 per minute for $20 gold pieces, and, of course, at a much higher rate for the smaller denominations. Next the blanks are placed in a machine where the edges are upset, this process serving to give to the edge additional hardness. Then to correct any brittleness imparted to the metal by the foregoing manipulations, the blanks are annealed in a cylindrical gas furnace, where they are caused to travel through a spiral-shaped passageway, each blank taking three minutes to pass through the furnace. The next process is to put the blanks through a bath of sulphuric acid, after which they are washed and dried in a barrel-shaped revolving machine, known as a "riddle." They are then taken to the coining press above described.

The whole of this very interesting machinery was built at the Philadelphia Mint, and at the close of the St. Louis Exposition it will be taken to Denver, and installed in the new United States Mint at that city. On account of the great cost of its installation and operation, it is probable that the present exhibition is the last of its kind that will be made by the United States government.

A NOVEL SPEED INDICATOR FOR AUTOMOBILES.

The device illustrated herewith has been recently perfected and placed on the market by Mr. Hartwell W. Webb, a young inventor of this city, who is possessed of a good technical education coupled with considerable ability. Mr. Webb's idea was to construct a speed indicator that could be used on automobiles and for other purposes, and which would have no parts to break or give out under severe usage. How well he has succeeded can be seen from a glance at the picture, which shows, at the left, the instrument, and, at the right, the parts that are placed on and near the wheel, while the rubber tube is shown in a coil, connecting them. The substantial ring shown is attached to the wheel of the automobile by three clips having oval slots, which make it easy to properly center the ring. A small gear pump is driven by an exterior bronze gear meshing with the teeth of the ring, as shown. This pump draws air in through three small holes in the bottom of the tube of the indicator, the exit for the air being through an outlet where the rubber tube is attached. The suction created by the pump raises a light aluminium plunger half an inch in diameter and weighing 5¼ grains, and the upper end of the plunger rod indicates the speed in miles per hour upon the scale. The bore of the plunger tube increases slightly toward the top, so as to make the air current always raise the plunger proportionally to the increase in speed. The extreme simplicity of the apparatus is apparent. There are no mechanical parts to get out of order or no liquids to leak out in case of breakage. A flexible driving shaft is not required between the wheel of the automobile and the indicator, all that is necessary here being a rubber air pipe. Besides its simplicity, the instrument is accurate, and its readings are correct to within two per cent. It begins to indicate at as low a speed as two miles an hour, and it indicates, without perceptible deviation, from that up to the maximum. The index never oscillates no matter how rough the road, and it is perfectly balanced in all planes that it is likely to be moved into in practice. A suitable hinged bracket for attaching the indicator to the dashboard makes it possible to tilt the device so that it can be easily read from the seat. The scale is sufficiently large to be read at a distance of twenty feet, and the indicating plunger of aluminium tubing is painted scarlet and arranged to move up and down in a glass tube placed behind the beveled glass front. The only wearing part is the gear pump, and this is exceedingly well constructed, the shafts of the two gears running in long, dust-proof bearings and one of the gears being made hollow so as to contain oil enough to last one thousand miles. The recent advent of high-speed steels into the manufacturing world has rendered necessary some means of gaging cutting speeds without the computation required by the use of a counter and stop-watch. A portable variation of the Webb speed indicator has been arranged to give at a glance from a single index both the peripheral speed in feet, and the number of revolutions, per minute. The blower and indicator are each provided with a handle, the blower being held to the work with one hand, while the indicator is brought to the level of the eye with the other, a flexible tube connecting the two parts of the apparatus. The indicator in this instance has a different scale on each side of the center tube, one indicating feet per minute, and the other revolutions per minute. Besides this instrument, a stationary tachometer is also made for power and electric light plants, and a shaft speed indicator for vessels and automobile boats is in course of preparation. All types of this new instrument are being placed on the market by the Webb Company, Park Row Building, New York.

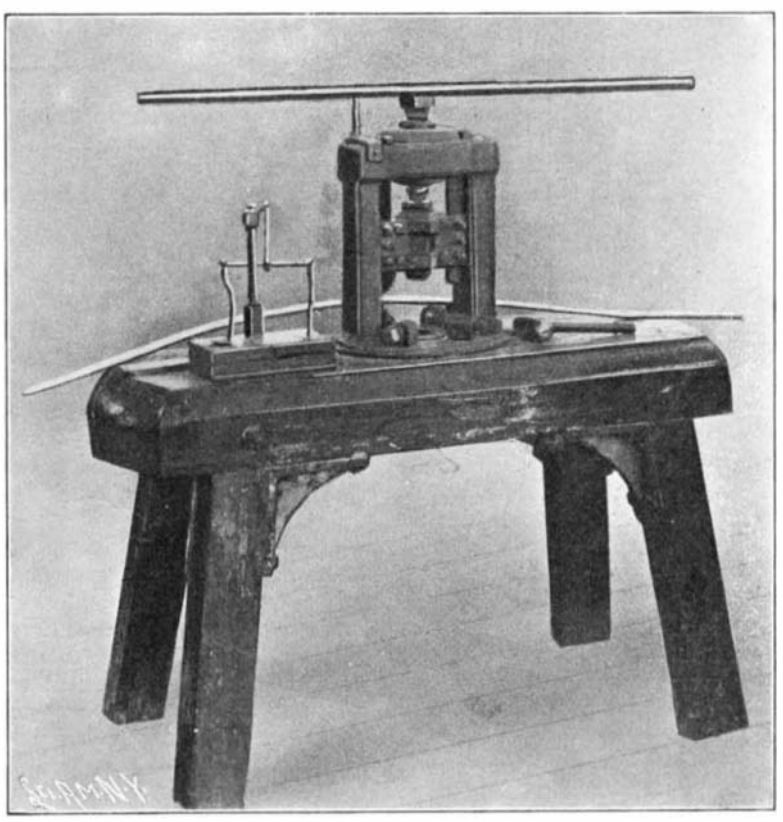


A NOVEL AUTOMOBILE SPEED INDICATOR.

Baldwin's Successful Flight.

With A. E. Knabenshue, of Toledo, Ohio, in the basket, Capt. T. S. Baldwin's airship flew through the air at St. Louis October 25, in the face of a ten-mile breeze, at the height of half a mile for a distance of about ten miles. Baldwin's airship was described in a recent number of the SCIENTIFIC AMERICAN. Several accidents occurred during the trip, the more serious of which was the breaking of a chain, which caused the operator to open the gas valve, bringing the craft to the ground.

Andrew Carnegie is now the recipient of one of the greatest honors in the industrial world, for the Bessemer medal has been conferred upon him. It is given only to those who are prominent in the iron and steel industry. This medal was established in 1873 by the great English iron-master from whom it is named.



FIRST COINING PRESS USED IN THE UNITED STATES MINT. OVER ONE HUNDRED YEARS OLD.

MODEL OF A CONTINUOUS-FEED GAS PRODUCER AT THE ST. LOUIS FAIR.

(*Continued from page 312.*)

incandescent fuel. From the upper part of the producer is led away a large firebrick-lined conduit carrying away the hot gas to the furnace, or to the distributing main. On the top of the shell is mounted a cast-iron table, on the surface of which is carried a little water to protect it from destruction by the heat. Into this top is set the automatic feeding mechanism, which distributes the coal uniformly and continuously over the gas-making surface.

ACTION.—The oxygen contained in the mixed current of air and steam seizes upon the hot carbon of the fuel, and is converted into CO_2. This red-hot CO_2 passing upward through the fuel seizes another atom of carbon, and reaches the surface as CO (carbon monoxide) carrying with it the hydrogen liberated from the steam, also the nitrogen carried in by the air, and the volatile hydrocarbons contained in the coal, which are driven off merely by the heat without any chemical combination with the oxygen. The fuel is thus absorbed; the ashes which remain settle gradually downward as the under bed is dug away a little at a time. The gas comes away in immense volume, every pound of coal yielding from 65 to 75 cubic feet, but, of course, one-half of its volume is nitrogen, which does not carry any combustive energy except by reason of the fact that it is hot.

GAS FIRING.—The advantages of gas firing may be thus summarized: First, cheaper coals can be used; second, the coal is all received and handled at one point; third, the combustion in the furnace is perfect—an exceedingly important point; and fourth, most of the large waste heat of the direct-fired furnace is saved ("regenerated") and restored to the system when gas-fired. Sometimes, as in the case of melting furnaces, this feature alone means a saving of fifty per cent.

The system as a whole is very simple, and is now reduced, by means of the automatic feed, to practically a machine operation. Until the device was introduced by the Morgan Construction Company, four or five years ago, the coal was dumped intermittently in large quantities by hand upon the incandescent surface of the fuel bed. The result was an immediate rush of the rich volatile gases at lowered temperature, which brought in its train all sorts of troubles. This rush was followed by a period of lean gas formed by the slow oxidation of the carbon, mixed with hydrogen liberated from the steam.

ASHES.—The removal of the ashes and clinker has also been greatly simplified. The clinkers are formed in the hot zone of combustion by the melting of the ashes when containing iron and sulphur, but they are softened and broken by coming in contact with the steam as they gradually descend to the water basin in which the producer stands. Access is provided all round the circle with equal convenience, so that the man who tends it has no difficulty whatever in keeping the fire level just where it should be, by occasionally digging away the soft, wet ashes at the proper place.

FEEDER.—In the automatic feeding arrangement an upper coal reservoir is held stationary on standards, while a lower chamber forms an inclined spout which is slowly revolved by a ratchet motion, carrying with it a conical disk under the mouth of the upper chamber. The disk allows the coal to work through gradually as it revolves, and the revolution of the spout distributes the coal uniformly over the whole surface from center to periphery. This revolving member has to be closed against gas leakage, which is effected by the simple water-seals shown, which also serve to keep the whole apparatus cool.

The steam, in addition to its service in reducing the clinkers, is a most active agent in the gas production. Of course, in order to maintain incandescence, only a limited amount of steam can be carried in with the air supply; but that limited amount performs a most useful function. It absorbs a large proportion of the sensible heat of combustion, and is thereby broken up into its constituents, oxygen and hydrogen. The hydrogen is good gas, having the same heat energy per cubic foot as the CO; and the oxygen so freed, by combining with the carbon, diminishes to some extent the amount of air, and, consequently, the amount of inert nitrogen which has to be supplied. In other words, the more oxygen obtained from the steam, the richer the gas will be, because it will contain a less proportion of nitrogen; further, the gas is cooler, and consequently wastes less heat by radiation from the conduits.

ANALYSIS.—In a good steam-blown gas producer, automatically fed, the gas is of uniform quality, practically every minute of the day, and with an average quality of bituminous coal shows the following analysis:

CO	23 to 25 per cent.
H	19 to 17 "
CO_2	4 "
Hydrocarbons	6 "
N	48 "

Such a gas as it leaves the producer will show (including its sensible heat) about 180 heat units per cubic foot, and when properly applied will effect any metallurgical operations requiring the highest temperatures just as perfectly and economically as it will annealing or heating operations at lower temperatures.

Automobile Notes.

Three grand prizes awarded for the finest automobiles at the World's Fair were given to the Haynes-Apperson, the George N. Pierce, and the Pope Manufacturing companies for their respective exhibits. The White Sewing Machine Company received a grand prize for its exhibit of White steam cars, and the Woods Motor Vehicle Company one for electric autos.

A novel test of a 10-horse-power Oldsmobile touring car made recently consisted in coupling the machine to a 17,200-pound trolley car loaded with 51 passengers, whose aggregate weight was 6,885 pounds, thus making a total weight of over 12 tons. The automobile pulled the street car at a fair rate of speed, notwithstanding that it had to turn the heavy electric motors geared to the axles of the latter, besides hauling the extremely heavy load.

It is reported that there were no less than 22 heavy cars and 34 motor bicycles in use in the recent German army maneuvers. The cars were first concentrated at Berlin, and then followed the divisions of the army to different points. The army, however, does not possess such a great number of cars as yet, and the different constructors were called upon to fill out the number, with the understanding that the makes which proved the best during the maneuvers would be favored when it came to giving future orders for cars. Steam tractors are used for transporting different kinds of army supplies. The authorities have decided that in time of war the automobiles belonging to private individuals will be called into requisition, according to the system which now prevails in the case of horses. At present the automobile detachment of the army consists of 40 men who are in permanent employ. To this number were added 28 infantry during the whole term of the maneuvers.

The series of mechanical tests which is being made upon automobiles at the Conservatoire des Arts et Metiers in Paris this month will no doubt prove instructive in many ways. These tests are quite extensive, and the mechanical laboratories of this institution are now very well equipped for this kind of work. Different systems of transmission for automobiles will be given a thorough trial. Thus the cars will be tested as to the strains and shocks which are given to the transmission bearings, first upon a rolling flexible platform which will be sufficiently smooth to be compared to a road in good condition, and then upon a platform which contains small pieces or projections spaced at unequal intervals. These will produce a series of shocks such as the car would receive when traveling over a poor road. It is claimed that the longitudinal universally-jointed driving shaft and the chain transmission give results which are quite different according to the state of the road. As this is a question of great interest and one which has not as yet been experimented upon properly, the present tests are quite timely and will be of considerable practical value. The tests of transmission mechanism will include those made upon isolated motors, as this is indispensable in order to find the efficiency of the transmission devices. Therefore the programme will be extended, and on account of the interest which arises from comparing the different types of motors, the constructors can engage isolated motors which will be put through different tests together with their carbureter and the liquid combustible which the constructor chooses as the best adapted for the case. Besides, it seemed useful to establish a parallel between the efficiency of a car which has been in use for some time, and a new car. Accordingly, it was decided that a chauffeur could have his car tested, at the same time stating the date of purchase, the kind of usage it had, the repairs, etc. A certificate of the test will be delivered which will be of great service to a proprietor who wishes to dispose of his car. The jury is composed of prominent experts in automobile and mechanical work.

Clark Caryl Haskins, who was well known as an electrical expert and writer as well as an inventor, died recently at his home in Chicago after a somewhat prolonged illness. He was born in Buffalo, N. Y., in 1827, and in 1844 is said to have sent the first electrical message which was ever exchanged between two countries, the communication having been sent from Buffalo to Queenstown, Canada. His most notable achievement was that of evolving the multiple switchboard now generally in use for telephone purposes, and which makes it possible to operate any number of lines from the same exchange. He had resided in Chicago since 1879. His father, R. W. Haskins, was also well known in scientific circles as an authority and a writer.

Correspondence.

Two Letters on the Zebra Wolf.

To the Editor of the SCIENTIFIC AMERICAN:

In the last issue of the SCIENTIFIC AMERICAN was an article by Mr. J. Carter Beard concerning the white raccoon dog, *Nyctereutes albus* (Hornaday) and the Tasmanian wolf, *Thylacinus cynocephalus*. Speaking of the last species, he says it is "so far as the writer knows, the first animal of its kind ever seen on this side of the Atlantic." To correct a wrong impression here created, I wish you would publish a statement to the effect that there are three live specimens of the zebra wolf in the Washington National Zoological Park, one female and her two young. In the Seventh Annual Report of the New York Zoological Society (1902), Mr. Hornaday, in his Report of the Director, says of the Tasmanian wolf that "only two specimens are on exhibition in Europe, and four in America."

D. D. STREETER, JR.

Brooklyn, N. Y., October 25, 1904.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with pleasure the account given in the SCIENTIFIC AMERICAN for October 22 of the "Tasmanian Wolf" in the New York Zoological Park.

You may be interested to know that the National Zoological Park also has specimens of this unusual animal, and I send herewith a pamphlet in which is given an illustration of two individuals. The mother and two young, received in September, 1902, are in excellent condition, and a male of this species has recently arrived. FRANK BAKER, Superintendent.

Washington, D. C., October 26, 1904.

The Ethiopian and His Skin.

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to add one more hypothesis to the number of those which correspondents of the SCIENTIFIC AMERICAN recently made to explain the difference in pigmentation between the negro and the white man. We have now every reason to believe that both the Mediterranean and the Baltic branches of the white race are the result of the natural selection practised by a cold climate upon northward-migrating African negroes. Whatever be the cause of the amount of pigment existing in the skin of the latter, it seems to me that the decrease of it was unavoidable as soon as the race took to traveling northward. In northern countries, natural selection tends constantly to harmonize with the color of the snow that of every animal which hunts or which is hunted; why should the blondness of the northern man have a different origin? Primitive tribes were doubtless frequently decimated by hunger, as the Canadian Indians are to-day. Those hunters who show on the snow a sallow face, black hair and beard, dark eyes, worked at a disadvantage when compared with somewhat lighter-complexioned comrades. They were more conspicuous on the white field, and could not so easily approach their prey within striking distance. In time of famine, mortality was the greatest in their families. The eliminating process was repeated generation after generation, the light-complexioned individuals always leaving the larger posterity. However small may have been the difference in the mortality, we know to-day that a characteristic against which such a process is at work, always in the same direction, is doomed to disappear.

GUSTAVE MICHAUD.

Springfield, Mass., October 18, 1904.

Plants and Drought.

Mr. S. A. Skan notices in the Botanical Notes of Knowledge a paper by Prof. D. H. Campbell on the remarkable vitality exhibited by the fronds of the "gold back fern," *Gymnogramme triangularis*, which grows in the neighborhood of Stanford University, California. In the resting season the fronds of this fern do not die down, as is commonly the case in ferns, but they dry up and persist, and to all appearances are dead. However, on placing such a frond in water its freshness and activity are quickly restored by the absorption of water through its superficial cells. The prothallia of this fern are able to survive complete drying up. Some were allowed to remain perfectly dry during the whole summer of 1903, and on receiving water in the autumn produced numerous young plants. Prof. Campbell refers to certain devices in Liverworts for preventing excessive loss of water during periods of drought. In some the growing point is protected by hairs or scales, which sometimes secrete mucilage; while the life of others is continued by the development of tubers, which, being more or less subterranean, are less influenced by a dry season.

The harbor works at Gizon have been in course of construction for some years, and will take several more years to complete, though the work proceeds steadily and regularly, and when finished Gizon will be a place of considerable importance as a seaport.

THE MUSICAL WINGS OF INSECTS.

BY S. FRANK AARON.

The songs of birds and the trills of the toad and tree-frog fraternity are about the only musical sounds in nature that are throat utterances or true songs. The great host of insect musicians are performers upon instruments; and though they play upon fiddles and castanets that are a part of themselves, the sounds they produce are truly instrumental. The tunes they play, often incorrectly called songs, have been largely studied and set down, but little else has been made known concerning the manner in which the sounds are produced.

The winged musicians are commonly of two kinds; those that use their wings as instruments, and those that do not. Of the latter we have the cicadas or harvest flies (incorrectly called locusts). These perform upon abdominal plates like castanets, the sound produced resembling the nature of its production. The true wing performers are the crickets and long-horned grasshoppers, or true locusts, of which the katydid is a notable and characteristic representative. These fellows—for it is always the males, the sports and lovers of the insect world—perform serenades by the hour, no doubt addressed to their "mistress' eyebrow," on what might be called living fiddles.

With sharp eyes and keen ears one may, with a little trouble, make observations upon these insects, many of which are diurnal; and if we penetrate the forests of grass and weeds and bushes from latter July until early October, moving always cautiously and remaining motionless for minutes at a time, we shall often be rewarded by a sight of the little fiddlers.

Many of the players are nocturnal; the cricket on the hearth, whose cheery notes go far to make him popular with the country folk; the little snowy tree cricket (*Oecanthus niveus*), whost strict observance of time gives the repetition of his little tune the regularity of heart pulsations, varied only with the temperature of the air; the denizens of the deep rocky crevices and caves; those that insist that "katy-did and didn't"—these we shall seek best with lantern held before us; and when thus armed, often they will come to seek us.

Most insects are devoid of hearing, and it is remarkable that stridulation occurs at all. The locusts and crickets possess acute hearing. Their courtship is carried on entirely through the medium of their serenades. The males remain in one spot playing upon their instruments. The females, undoubtedly attracted by these songs, seek the players here and there with untiring energy.

And most remarkable is the character of the sounds produced in relation to the instruments played upon. These instruments are apparently not resonant. Indeed, they seem much too flimsy to produce metallic and far-reaching sounds. Except that the sound-producing portion of the wings, though varied in construction, is quite unlike the musical instruments of man, there is a resemblance in the tightened parchment-like sounding-board and the manner in which the wings are scraped together that partakes somewhat of the nature of a stringed instrument.

With the crickets proper the wings are raised almost or quite vertically while stridulating. With the locusts the sound-producing organs are elevated, so as to permit a scraping motion.

The musical organs are always attached to the fore wings. The hind wings are only used for flying. The fore wings of the cricket are for the most part taken up by the sound-producing, tightly-stretched portion. This part is strongly, but openly veined, and the toothed vein or bow extends entirely across this horizontal portion near its base. The roughened edge, where the toothed bow scrapes, is upon the inner margin. The right and left fore wings are precisely alike, so that either may be used for the bow or the fiddle.

In the Locustidæ there is presented to us one of the most remarkable developments in nature. A functional external difference in the two sides of an animal is indeed rare. Perhaps it does not occur elsewhere, yet every species of the Locustidæ possess this remarkable character in the wings. It is not observable in the Grillidæ, and certainly no other insects whatever do possess it. The inner basal portion of the right fore wings of the locusts consists of the broadened membrane and relatively more open-veined portion. This is the fiddle. The corresponding portion of the left fore wing is neither so membraned nor veined, but there is here a broad, stout vein situated very near the base which constitutes the bow. (See Fig. 3.)

Nature's habit of symmetry, however, has also placed this same bow vein, though less strongly developed, in the fiddle membrane of the right wing. It has become atrophied through disuse. (Fig. 3, *f* and *g*.)

During stridulation the wings of the locusts are held parallel to the body, the greater portion being vertical, and the musical basal portions horizontal and overlapping the back and each other. This brings the bow of the left wing in a position to move back and forth upon the edged and resisting veins that margin the membrane of the right wing. The bow, in order to cause greater friction, and therefore create sound, has, underneath, file-like ridges which are longest in the broadest portion of the vein. This roughness can be well seen with a low-power microscope.

In the locusts it consists of from twenty to one

Fig. 1.—Common Grass Locust. *Orchetimum vulgare.* Male Stridulating.

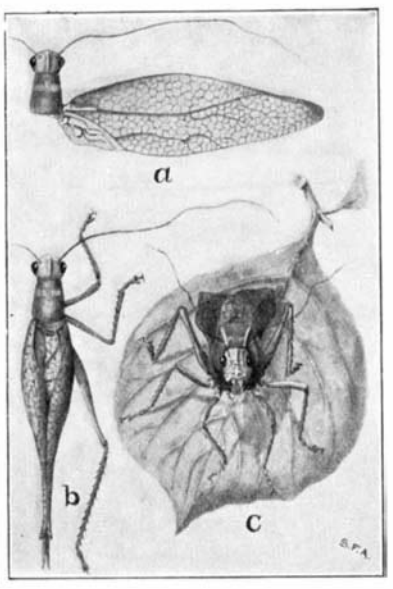


Fig. 2.—Angular-Winged Locust. *Microcentrum retinervis.* Male.

a. Right fore wing showing "fiddle" at lower base. *b.* Dorsal view with wings closed. *c.* Front view while stridulating.

hundred sharp straight ridges. In the crickets these are modified somewhat into T-shaped and scale-like elevations, and the bow is longer than that of the locusts; the wing motion, while stridulating, being more apparent.

The extreme convexity of the fore wings, the sound-producing portion being almost at right angles to the

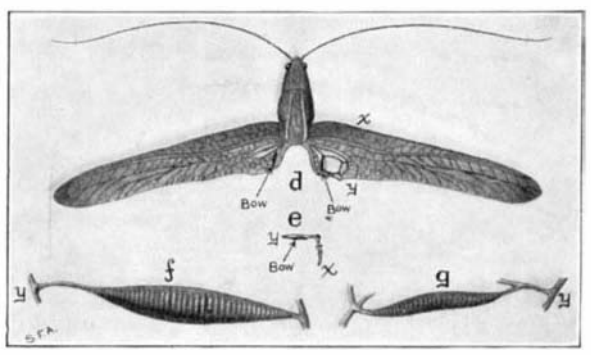


Fig. 3.—Cone Head Locust. *Conocephalus ensiger.* Male.

d. Head, prothorax and fore wings, showing fiddle and bows. *e.* Section of fore wing near base. *f.* Magnified bow in left wing showing file-like ridges underneath. *g.* Magnified bow in right wing. *x* indicates anterior margin and *y* posterior (inner) margin of wings.

vertical anterior portion, tends to stiffen the wing and apparently gives the fiddle a more resonant character. Where the sound is a continuous buzz or rattle, the fiddling motion is very rapid. The tree cricket, katydid, and other species move the wings slowly, as may be surmised from their notes. The sound produced by most species of the locusts and crickets is of a rasping character, just as one might expect from the study of the organs producing it. Some species, however, possessing no more rigid or otherwise distinctly varied musical organs, sounds that are very remarkable. Most notable among these latter is the angular-winged locust (*Microcentrum retinervis*), sometimes called katydid, from its superficial resemblance to that species. The notes of the angular-winged locusts are without variation; they simply begin slowly and end rapidly. When heard at a distance, they emanate from such a source. The sound is much like that of striking two small pieces of metal or hard flinty pebbles together rapidly, producing a "chip, chip." How such metallic sounds can emanate from the insect crust is seemingly beyond explanation. Mr. Scudder and Hamilton Gibson have faithfully described the music of many of our locusts and crickets. There is a wide variation between the notes of the different species; moreover, there is a difference between the night song and the day song of certain species. It is an interesting study, and the nature lover may easily profit thereby.

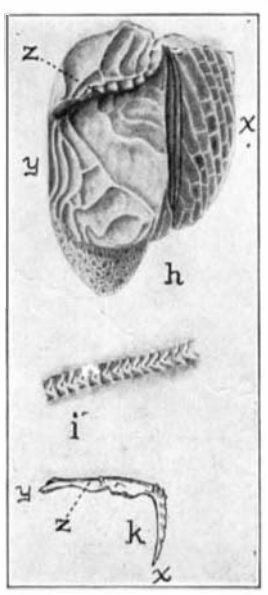


Fig. 4.—Right Fore Wing of Common Big Black Field Cricket. *Gryllus abbreviatus.* Male.

h. Wing flattened out. *i.* Magnified "bow" vein showing roughened scaly ridges underneath. *k.* Section of fore wing near its base. *x* indicates anterior margin and *y* posterior (inner) margin of wing. *z* indicates position of bow.

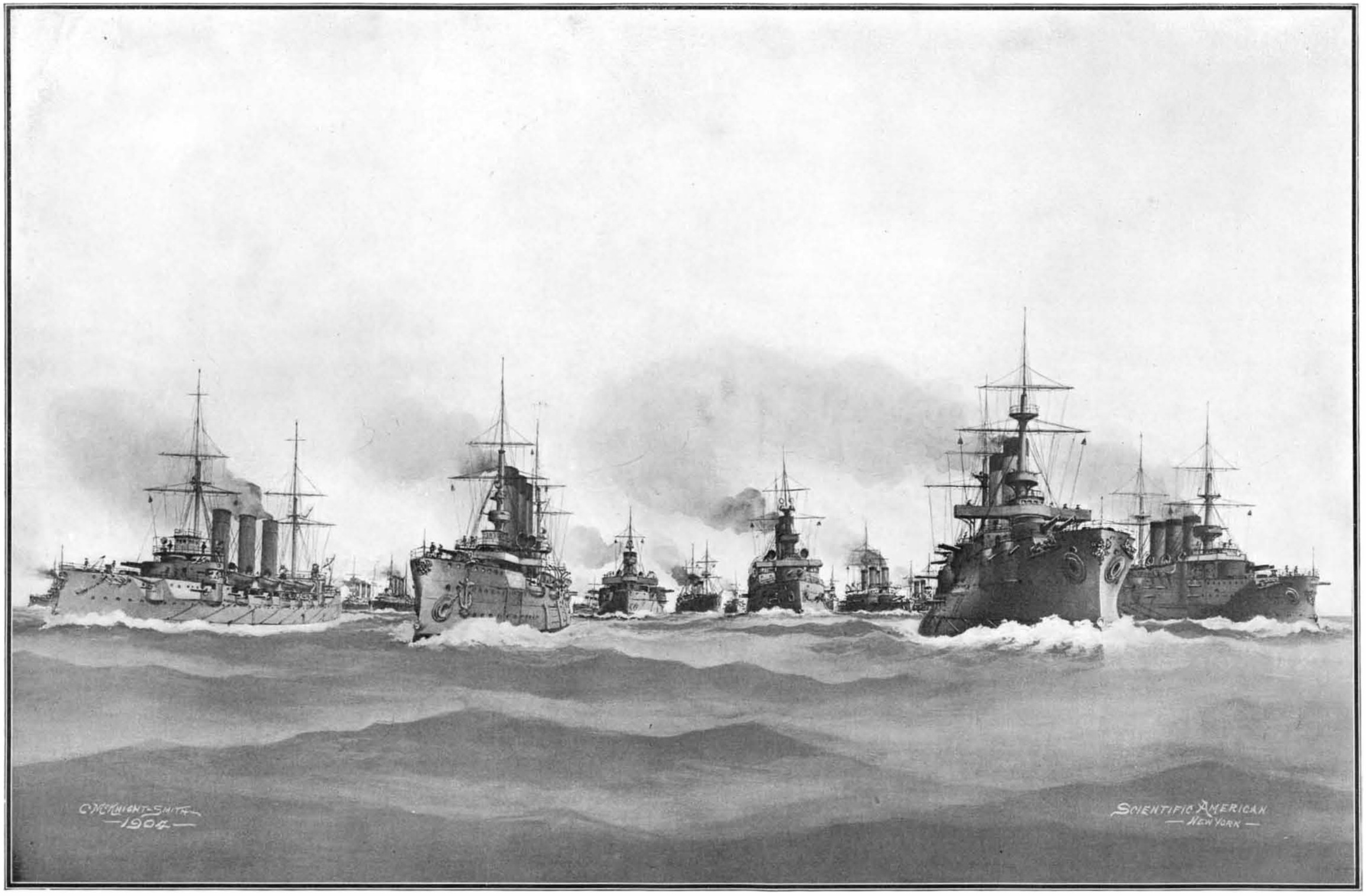
The Blue Color of the Heavens.

The blue color of the heavens is a subject which Prof. Spring of the Liege University recently treated in a conference before the Swiss Natural Science Societies during the late congress. He classes the explanations which savants have given up to the present as to the blue color of the heavens in two categories. The physical type is based mainly upon the experiments of Tyndall regarding the illumination of vapors. The chemical type is the more recent, and is based on the actual color of the atmospheric components. The former experiments which led to the physical theories of the blue color seem to have been borne out by the recent experiments of Rayleigh upon the reflection of light by the particles of a troubled medium, and these are found to reflect a great number of rays of short wave-length. This causes such a medium to appear red by transparence and blue by reflected light. Besides, the plane of polarization has the same direction as in Tyndall's experiments. M. Spring, however, absorbs all the blue light from the heavens by means of an appropriate absorbent medium, and thus observes that the polarization of the light in the beam is not a sufficient proof of the optical origin of the blue color, since it is demonstrated that other wave-lengths are polarized. The objections to Rayleigh's theory which are made by Pernter, of Vienna, strengthen his view; Rayleigh's theory would lead us to predict a violet color, rather than a blue, for the heavens. Besides, the dust particles of all kinds which the atmosphere contains do not rise to a height of over 3,000 to 6,000 feet, and the action of gravity and also the electric state of the atmosphere tend to precipitate them. The question arises whether it is the molecules of the gas itself which produce the solar reflection. This seems to be denied by L. Soret's experiments, which prove that this hypothesis does not hold good for liquids or solids, and more recently the author finds negative results in the case of gaseous particles. Hagenbach explains the illumination of the atmosphere by attributing it to a series of layers of different densities which cross and intermingle, thus causing reflection and refraction of the light rays. The author considers that such a theory would be satisfactory to account for the illumination, but cannot be used by the partisans of the physical theory to explain the color of the heavens. In fact, it accords very well with the chemical theory of the blue color. The author then made a series of original experiments to prove that a troubled medium will only seem blue to an observer who is plunged in it, in case the medium itself possesses a blue coloration. In the case of the atmosphere, the author upholds the theory of an inherent blue color by his calculation that the oxygen contained in the air, leaving out the possible effect of ozone, is sufficient to give the medium a deep enough color to explain its actual appearance and the variations we find in the different directions of sight. These calculations are based upon the liquid state of the gas. The dust particles, instead of being the cause of the blue color, only have the effect of obstructing it to a greater or less extent, and thus cause the variations which are observed.

The Current Supplement.

The title of the article that opens the current SUPPLEMENT, No. 1505, is the "Manufacture of Sawed and Sliced Veneers." The article was written after a careful study of a great plant near New York city, and the photographs were taken especially for our purposes. Of technological interest are an article on "Enamel and Its Present Application," and an account of electric welding with illustrations. Sir William Ramsay contributes some suggestive remarks on "Recent Chemical Research." Brigadier-General J. P. Farley writes on "Recoil," a subject which has engaged the careful attention of ordnance experts for some years past. A. W. Oppenheim contributes a valuable discussion on the Diesel engine, accompanying his analysis of its engineering possibilites by many diagrams. Prof. T. W. Richards writes on the relation of the hypothesis of compressible atoms to electrochemistry. "Scientific Agriculture" is a subject upon which William Somerville read a paper before the British Association for the Advancement of Science. Miss Agnes Clerke, one of several modern women famous in science, writes most instructively on the forms of nebulæ.

The Marquis de Dion has designed a new submarine of 100 tons displacement, to carry a crew of five, and driven by a motor of 200 horse-power. A model of the invention has been presented to the French Minister of Marine.



Cruiser Jemtchug. Cruiser Oleg. Cruiser Izumrud. Cruiser Svietlana. Cruiser Almaz. Cruiser Aurora. Cruiser Nakhimoff. Battleship Alexander III. Cruiser Dmitri Donskoi. Battleship Orel. Battleship Sissoi Veliky. Battleship Suvaroff. Battleship Navarin. Battleship Borodino. Battleship Osliabia.

THE BALTIC FLEET FOR THE RELIEF OF PORT ARTHUR.—[See page 318.]

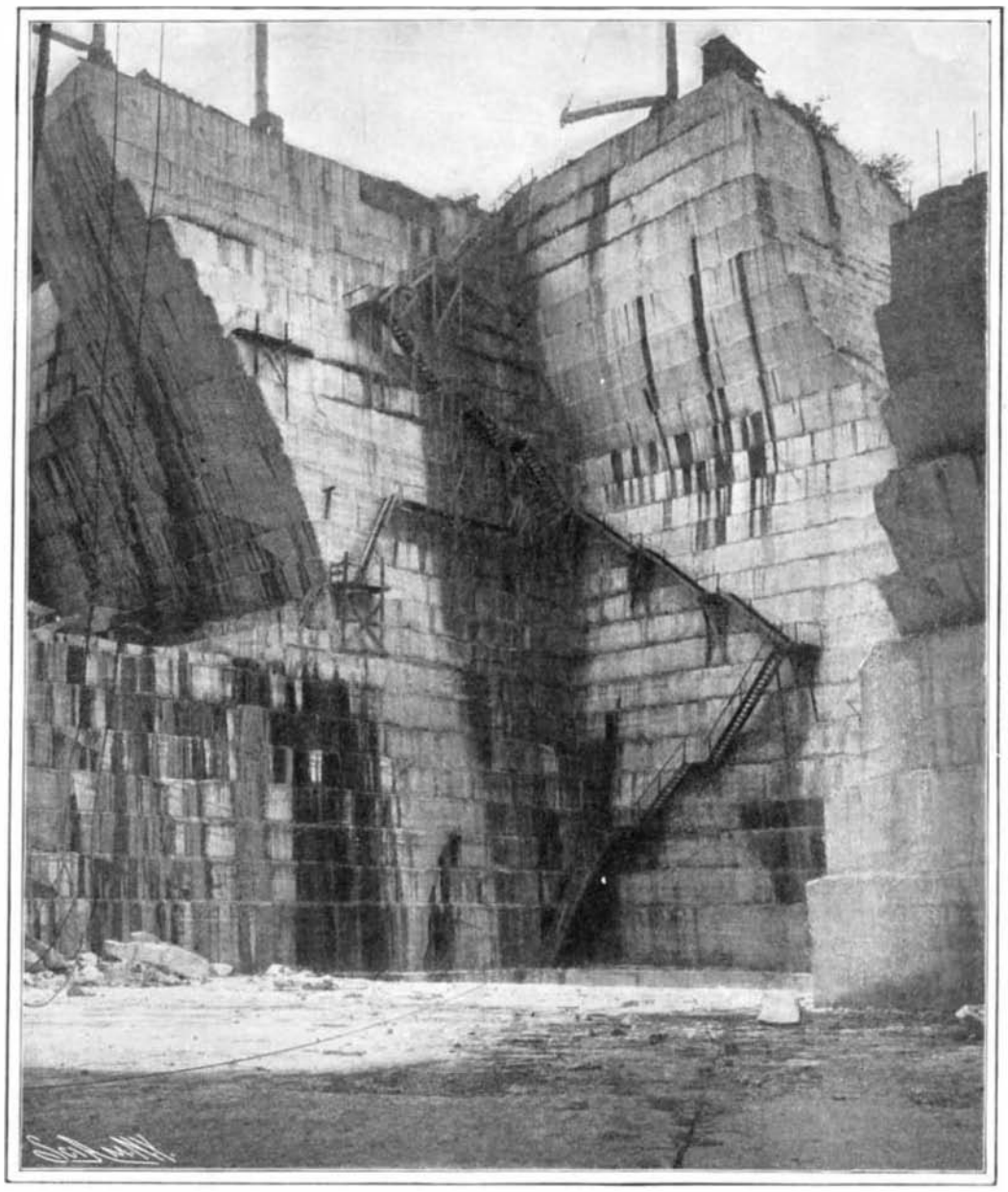
THE CARRARA OF AMERICA.

BY DAY ALLEN WILLEY.

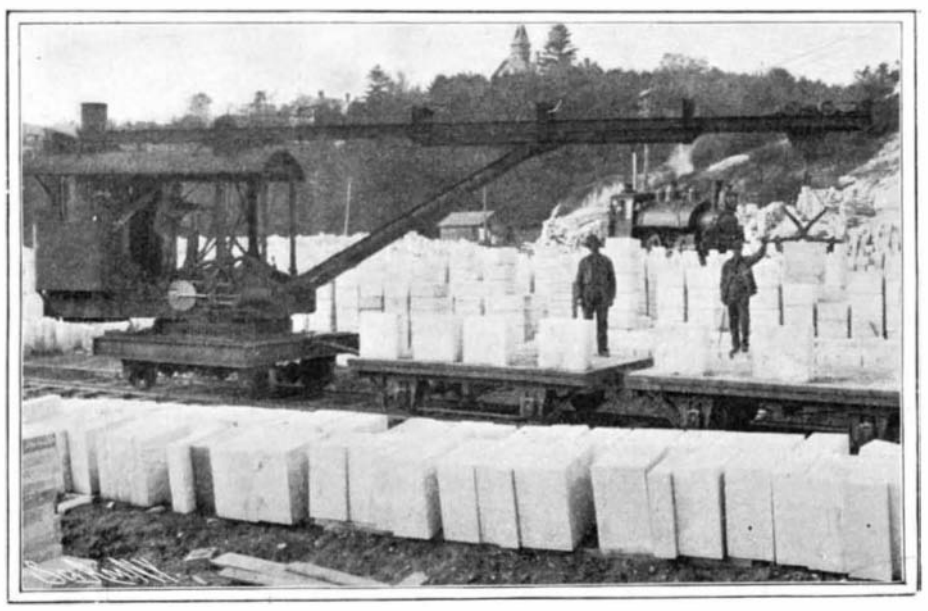
The marble industry of Vermont is interesting, not only on account of its magnitude, but its comparatively recent inception, although located in one of the oldest of the United States. It forms a striking illustration of the fact that New England has natural resources which are just beginning to be appreciated. Yet as early as 1792 it was known that deposits of marble existed in the State named, and a few blocks were taken from surface beds early in the present century.

The extent of operations in Rutland County, where the most extensive quarries have thus far been opened, indicates, however, that this resource is one of the most important not only in New England, but in the United States, and that the supply is of very large proportions. One of the most interesting features connected with the deposits is that they vary to such an extent in color and quality. The ordinary white marble used for buildings is found in abundance, but in addition a variety of the grayish-white tint for which Greece is so noted has been obtained, as well as layers with black, blue, red, and greenish hues. While much of this deposit is of one color, other beds are so blended that marbles representing a combination of tints in mottled and striped patterns are worked as well. Several of the kinds which have been secured bear a striking resemblance to the famous Pentelic marbles, of which some of the most noted structures in Greece were built while a variety which is very similar to the statuary marbles of Italy, on account of its translucent quality, is being obtained and utilized for statuary. By reason of the extent and variety of the marbles thus far obtained, Rutland County has also been called the Carrara of America; but geologists who have studied the formation, are of the opinion that the deposit is of far greater proportions than the Italian beds referred to.

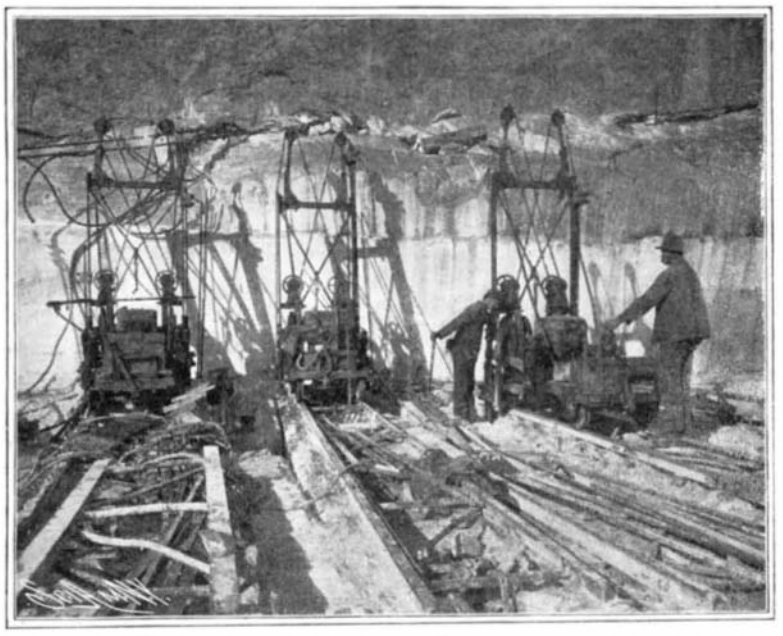
Although, as already intimated, the industry is comparatively new, it has progressed so rapidly that some of the quarries in the vicinity of West Rutland are of unusual dimensions. One has been excavated to a depth of nearly 300 feet, and at the bottom is nearly 2,000 feet in length. From it has been taken an enormous quantity of material for buildings alone, but the beds are of such size that even at the depth mentioned, marble of such a high grade has been secured that it was profitable to work it. An examination of the strata as revealed by the walls of these quarries shows that several varieties both in color and composition may be found in proximity with each other, the deposits occurring in regular layers separated by a natural cement, which occurs in partitions of varying thickness. The layers of marble range in width from a few inches to over ten feet, and consequently blocks of very large size can be secured for foundations, obelisks, and for other purposes where massiveness is required. As may be



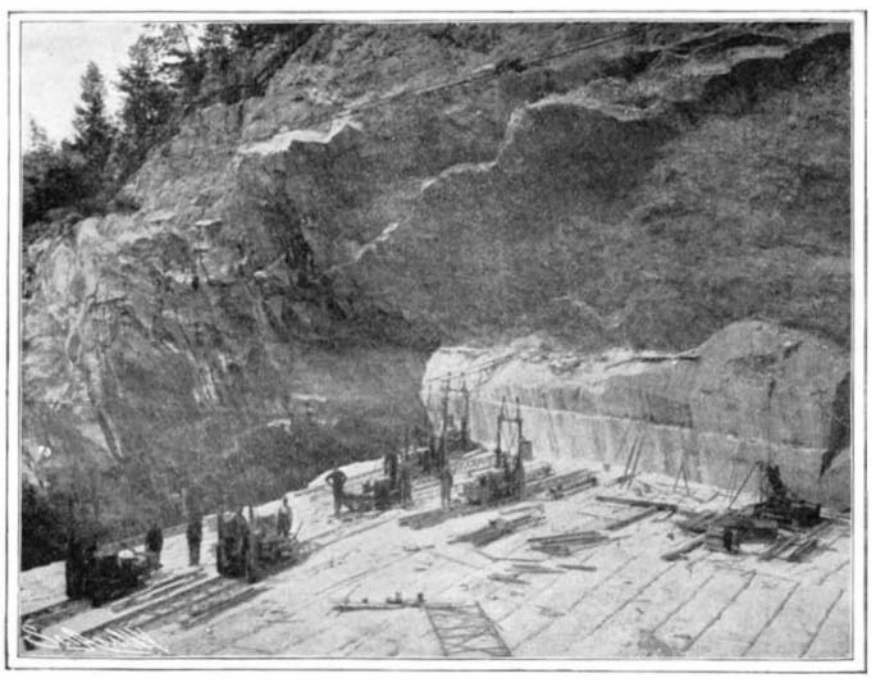
A Vermont Marble Quarry 200 Feet Deep.



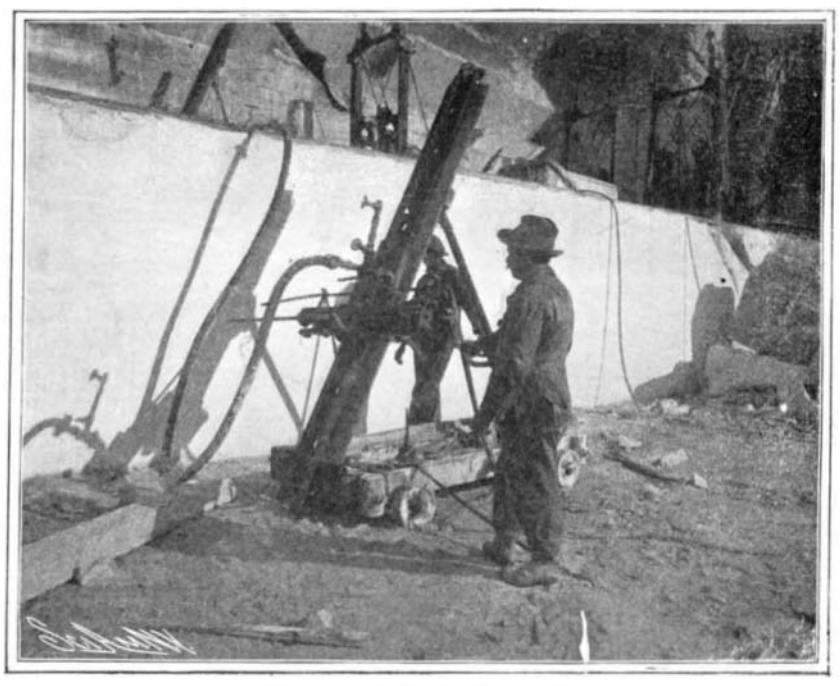
One of the Locomotive Cranes in Use at the American Carrara.



Channeling Machine at Work, Showing Vertical and Horizontal Cuts.



Quarry at Proctor with Gang of Electric Channeling Machines.



Type of Steam Drill Used in Quarrying.

THE CARRARA OF AMERICA.

imagined, in securing the marble from the beds, some very interesting machinery is employed. In the quarries of the Vermont Marble Company, at Proctor and West Rutland, are installed what are termed channeling machines, which are operated by both steam and electric power. One of this type is known as the Sullivan channeler, after the inventor. It travels back and forth on a track which is pinned to the solid rock, making a ridge or channel which averages one and one-fourth inches in width and ranges from four to ten feet in depth. This incision is made parallel with the rails of the channeler track, but a few inches to one side. The machine cuts but one channel at a time, and in its operation is somewhat similar to the ordinary steam drill, with this exception, that the rotary motion is avoided. In order to cut the channel evenly, no less than five drills are assembled, each having a separate bit. They are so fastened together that they act as a single tool, but having five bits. Three of the bits are adjusted directly across the channel, while two are at an angle of 45 degrees. They are clamped into a head which forms a part of the piston rod connected with the steam cylinder, so that the power acts directly on the drills through the piston. The five bits combined really constitute a drill, which would be about seven-eighths of an inch by seven inches in dimensions. The movement of the channeler on the track is controlled by a separate engine, which is geared to the trucks. The capacity of the machine depends, of course, largely upon the hardness of the formation, but frequently one hundred feet of channel will be cut in a day.

Another type of cutting machine is known as the Wardwell, and can be operated either by steam or electric power as desired. It is also moved back and forth on a track, but makes a channel on each side of the track and parallel with it. In this apparatus the drills are also arranged in clamps in groups of five, the up and down stroke of the drills being obtained through a double system of levers connected with a crankpin on the crankshaft of the engine. Between the levers is a system of springs, also between the lower lever and the frame, and the motion of the machine along the track is secured by connecting the crankshaft of the engine with the trucks through a system of gears. With this type of the channeler there is a constant relation between the speed of the machine and the strokes of the drill. When electricity is used in place of steam power, a connection is made between the electric motor and the shaft by means of bevel gears. The Wardwell cutter is of special advantage for up and down or vertical work, where the channel can be made at fixed distances apart, but the Sullivan is generally used where the layers are of widths which vary considerably. In addition to these machines independent drills are used for what the quarryman calls "gadding," and where it can be employed with more economy than the channeler.

It is perhaps unnecessary to say that the use of explosives in connection with marble quarrying is practically impossible, since so much of the material would be shattered that the process would be attended with such waste as to be by far too expensive. Therefore a large number of the channeling machines referred to are installed. For elevating the blocks to the surface, powerful boom derricks are used, similar to many of those employed in the construction of large office buildings, the motive power being furnished by steam engines. For transferring the blocks from the quarry openings to the yards and marble "mills" as they are termed, several varieties of cranes are used, in which both steam and electricity are employed. The locomotive cranes are very valuable in connection with the industry, those at Proctor being provided with a horizontal jib or arm of unusual dimensions. It is built of steel girders, and is so massively constructed that it will handle loads of several tons without difficulty. The most powerful crane employed by the Proctor company is of the Whiting pattern. As the photograph shows, it is electrically driven, having a bridge available for use, of no less than 160 feet, with an overhang on each side of the legs of 50 feet, the distance between the legs being 60 feet. The crane travels on a track, and the loads are handled by two trolleys mounted on a bridge, each of 25 tons capacity. By means of an equalizing bar the trolleys can be connected and used in moving a single load, making the maximum capacity of the crane 50 tons. Material can be lifted to a height of 35 feet. This apparatus is principally used for loading trains, the cars being hauled beneath it, and the blocks quickly swung into position. In connection with the mills a crane of 10 tons capacity is used, which is called a half-gantry, from the fact that one leg moves upon a rail at the edge of the loading platform, while the truck at the other end of the crane travels on a rail which is attached to the mill building. This arrangement affords a clear passageway in the center, so that the material can be carried in an overhang, and facilitates the loading of cars.

At the Vermont quarries much of the marble is fashioned into tombstones, statuary, and other forms in the mills, which have been erected in some instances immediately over the beds. In the work of cutting the blocks pneumatic chisels are now extensively used. For cutting the slabs into suitable sizes sand-saws are used almost entirely. The saws are made of soft iron but without teeth, sand being substituted for the latter. Operated by steam power the iron blades move back and forth, forcing the particles of sand against the material, and thus cutting it. The sand is applied to the marble in a stream of water which is continually poured upon the surface. The process is somewhat lengthy, for from four to five hours are required to cut through a single foot, but the number of saws give this portion of the works a large capacity. It might be added that all of the sand used is brought a distance of several miles entirely by mechanical power and on its way is carried to a considerable altitude over a mountain by means of an endless cable carrying a line of buckets, which are automatically unloaded.

The recent date at which this industry was undertaken on an extensive scale can be appreciated, when it is stated that in 1870 the census reports show that the total valuation of marble obtained from the Green Mountains of Vermont was but $130,000. At present one company alone extracts material yearly to the value of $2,500,000. Over three thousand hands are employed in all of the quarries and mills, while the total investment of capital represents nearly $5,000,000; the value of the marble for buildings, statuary, monuments, and other purposes sent yearly from this district being nearly as much as the total investment.

THE START OF THE BALTIC FLEET.

The long-heralded setting out of the Russian Armada for the Far East has been signalized, at the very outset, by a fleet engagement, which is destined to rank as unique in naval history. We cannot recall another instance in which an admiral starting to the relief of a beleaguered and far-distant fortress, was so fortunate as to strike the first telling blow in home waters, and sweep through the enemy's lines, delivering his broadsides without the loss of a single man, or so much as the scratching of the war paint on his own battleships and cruisers.

The collision occurred at night and in thick weather. Warned by the fate of the Port Arthur fleet, Admiral Rojestvensky and his staff were keeping a strict lookout for torpedo attack, when suddenly they were confronted by a numerous fleet of suspicious-looking craft, filled with uncouth men, some of whom were wielding sharp knives, while others were seen in the very act of hauling and pulling on objects that were floating in the sea. Here, then, was the enemy, caught in the very act of sowing mines in the path of his Majesty's battleships. Despite the sudden peril that thus confronted it, the traditions of the Russian navy were nobly maintained. There was no panic—merely a sharp word of command—and the united broadsides of four of the very latest and most powerful battleships of the day opened with telling effect. After twenty minutes of spirited and accurate firing, in which the greatest self-possession was shown by all ranks, the admiral, seeing that the enemy made no reply, steamed to the southward, leaving behind him two fishermen killed, several wounded, and one fishing boat sent to the bottom. It is generally agreed that naval history, ancient or modern, fails to furnish a parallel, either in brevity or effectiveness, to this Battle of the North Sea.

Its effect upon the spirits of the beleaguered garrison at Port Arthur must prove to be highly stimulating; and there can be little doubt that such an astute admiral as Togo will make a mental note of the keen-eyed vigilance, dashing courage, and deadly efficiency shown thus early in its career by the Baltic fleet.

As regards the material of which the fleet is composed, although it includes four battleships which we consider to be, in some respects, the best in the world, the fleet as a whole is composed of so many different types, that it is totally lacking in that homogeneity which tacticians of the modern school consider to be of prime importance to the effectiveness of a fleet. The most important element is, of course, the four recently-completed battleships of the "Borodino" class, ships that are very similar to the "Czarevitch," now sheltering, badly crippled, under the protecting wing of a neutral port. They embody, however, certain improvements over that ship. The vessels are the "Borodino," "Orel," "Imperator Alexander III.," and "Suvaroff." They carry four 12-inch and twelve 6-inch guns, besides a numerous battery of smaller rapid-fire pieces. The belt of Krupp steel varies from 9 inches amidships to 4½ inches at the ends. The heavy guns are protected by 11 and 10 inches of armor, and the six turrets that contain the twelve 6-inch guns in pairs, carry six inches of armor. Theoretically, these ships are unsinkable by gun fire at ordinary battle ranges. In addition to the protective deck at the waterline, which is 4 inches thick, they have an upper protective deck, 2 inches in thickness, and the space between them is entirely filled with coal. Moreover, two vertical bulkheads of 4-inch armor extend throughout the ship at about 8 or 10 feet from the side. Compared with the latest battleship designs of other navies, the secondary battery of 6-inch guns is too light for its purpose. Our own "Connecticut" carries secondary batteries of 7 and 8-inch guns, the "Lord Nelson" of the British navy carries ten 9.2-inch guns in its secondary battery, while the latest Japanese carry four 10-inch guns.

The battleship "Osliabia" is practically a sister ship to the "Peresviet" and "Pobieda," now imprisoned at Port Arthur. She was half way on her voyage out to the Far East at the outbreak of the war, and was recalled because of the early naval ascendency gained by Japan. She is distinguished by an abnormally high freeboard of about 30 feet, and she would, of course, present a lofty target to the enemy. She is armed with four 45-caliber 10-inch guns and eleven 45-caliber 6-inch guns, besides forty-six smaller pieces. Her belt, which extends almost to the ends, is of 9-inch Harvey nickel-steel, with a shorter 5-inch belt above it, extending for a third of the length amidships. The 6-inch guns are carried in casemates protected by 5 inches of armor. The 10-inch gun is a powerful piece, but not by any means a match for the 12-inch wire-wound guns of the Japanese. The "Osliabia" carries two submerged and four above-water torpedo tubes. On trial she made a speed of 18.3 knots. The other two battleships are comparatively obsolete vessels, that could only find a place in a "scratch" squadron, such as this; the "Sissoi Veliky," built in 1894, is a ship of 9,000 tons and 16 knots speed. She carries four 35-caliber 12-inch guns of low velocity and six 45-caliber 6-inch rapid-fire guns. Her half-dozen torpedo tubes are carried above water. She has a partial belt of 16-inch Creusot armor, a deck 3 inches thick on the slopes, and 5 inches of protection to her 6-inch guns. The "Navarin," built in 1891, is a vessel of 10,000 tons and 16 knots. She carries four 12-inch guns of the same pattern as those on the "Sissoi Veliky," and eight 45-caliber 6-inch pieces. Her 16-inch waterline belt and her 12-inch turrets are protected by the old compound iron and steel armor, whose resisting power is very small against modern artillery. Moreover, she is a ship of low freeboard and limited coal supply. It is quite a question whether the crack battleships of the Baltic squadron would not be better off without these two old and inefficient "armorclads."

Of the cruisers, two, the "Admiral Nakhimoff," of 8.000 tons and 18½ knots, and the "Dmitri Donskoi," of 5,880 tons and 15.5 knots, are old armored cruisers. The former was launched in 1885, and the latter in 1883. The "Admiral Nakhimoff" was reconstructed in 1899, but she still carries the soft compound armor, as does the "Donskoi" also. The "Nakhimoff" is armed with eight 6-inch and ten 4.7-inch, and the "Donskoi" with six 6-inch and ten 4.7-inch guns, of modern type. These two obsolete craft can never hope to stand up against the modern powerful armored cruisers of Japan, like the "Asama."

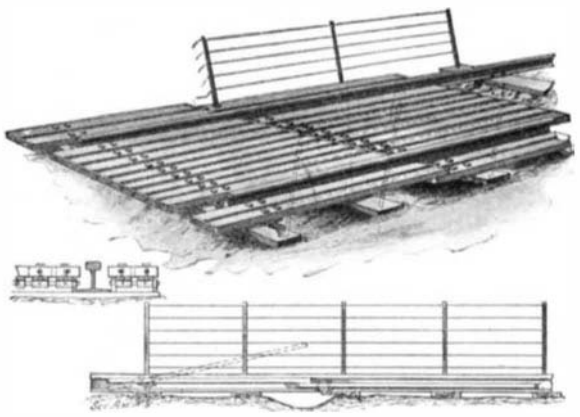
The fleet also includes six protected cruisers, whose presence in the Far East can have only an indirect effect in raising the siege at Port Arthur. Their province will be to act the part played by the Vladivostock cruisers before they were put out of commission by Admiral Kamimura's squadron, namely, that of raiding the Japanese transports and merchant vessels. In this, because of their high speed, they can, undoubtedly, prove very troublesome to the Japanese by distracting the attention of the blockading fleets at Port Arthur and Vladivostock, and by constituting a menace to the Japanese communications by sea. The fleet consists of the "Aurora," of 6,630 tons and 20 knots, carrying eight 6-inch guns, sister to the "Pallada" and "Diana," now confined in Port Arthur; the "Oleg," of 6,250 tons and 23 knots, carrying twelve 6-inch guns, a new vessel of the "Bogatyr" type (the "Bogatyr" went on the rocks at Vladivostock, was floated, and is now repairing at that port); the "Jemtchug" and "Izumrud," of 3,200 tons and 22½ knots speed, carrying six 4.7-inch guns, sisters to the "Boyarin," sunk by a mine at Port Arthur or Dalny; the "Svietlana," of 3,900 tons and 21½ knots speed, carrying six 6-inch 45-caliber guns, besides the "Almaz," of 3,000 tons and 25 knots speed, carrying six 4.7-inch guns, a sister vessel to the "Novik," of which we heard so much during the earlier Port Arthur operations.

The fleet is proceeding to the Far East in two divisions, the smaller vessels, including the torpedo boats, going by the Suez Canal and Indian Ocean, and the larger vessels going by way of the Cape of Good Hope. What will be the fate of the squadron? We must confess that, in view of its auspicious start, it is impossible to predict with any semblance of certainty just what it may do. But one thing is certain—if it should succeed in navigating the 17,000 miles that separate it from the Far East, and should then meet and demolish the well-seasoned ships and crews of Togo and Kamimura, raise the siege of Port Arthur, and transfer the command of the sea from the flag of Japan to that of Russia, it will have accomplished a feat that seems, even with the Battle of the North Sea fresh in our minds, altogether beyond human possibility.

Patent Department

CATTLE GUARD FOR RAILWAY CROSSINGS.

A patent has just been granted to Mr. S. H. Summerscales, of Winnipeg, Canada (Box 737), on a cattle guard for preventing cattle from straying onto railroads from public crossings. The cattle guard is so

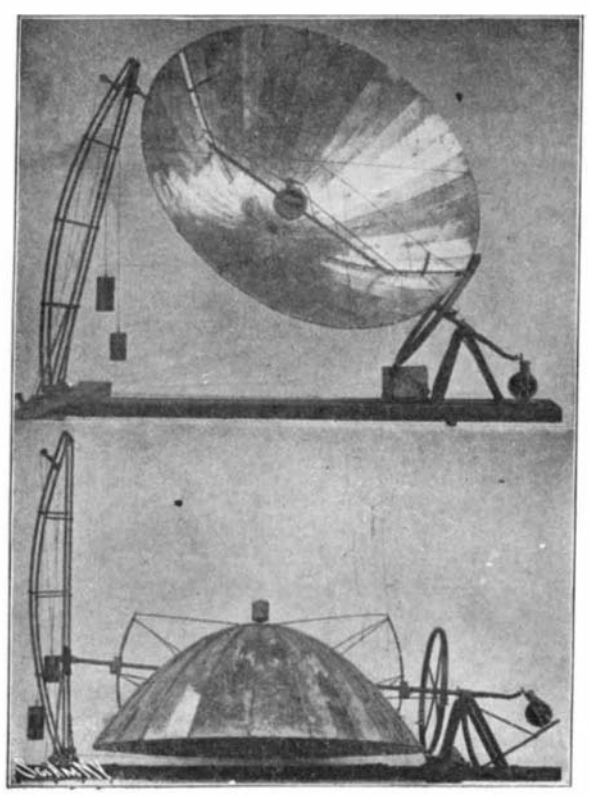


CATTLE GUARD FOR RAILWAY CROSSINGS.

arranged as to frighten the cattle away from the crossings, and thus effectually prevent their passage over them. The arrangement is clearly indicated in the accompanying illustration. At each side of the crossing is a series of hinged platforms, each series comprising a central platform between the rails and two outer platforms, one at each side of the track. These are separately hinged near their forward ends to one of the ties by means of rods passing through brackets on the platforms and supported in eyebolts in the ties. The rear ends of these platforms rest on the forward ends of another and a lower series of platforms. The latter are also hinged near their forward ends, but all on a single rod, and they are so connected as to swing together as a single platform. In operation, when an animal strays from the crossing and steps on the forward end of one of the platforms, the other end will fly up in front of it, and tend to frighten it away. But if this is not effective, and the animal proceeds past the hinge, the weight imposed on the forward end of the lower series of platforms will cause them all to rise in front of the animal, and thus effectually scare it off. A fence along each side of the railway prevents the animal from straying onto the track without first passing onto the hinged platforms.

SOLAR MOTOR.

A solar motor which has recently been invented by Dr. E. P. Brown, of Cottonwood Falls, Kans., is illustrated in the accompanying engraving. The apparatus embodies some very useful improvements over solar motors as heretofore constructed. The large reflector may, in time of storm, be reversed and lowered as indicated in one of the figures, when it will present much less resistance to the wind, and thus escape injury or destruction. The invention also comprises other improvements, as will appear from the description of the

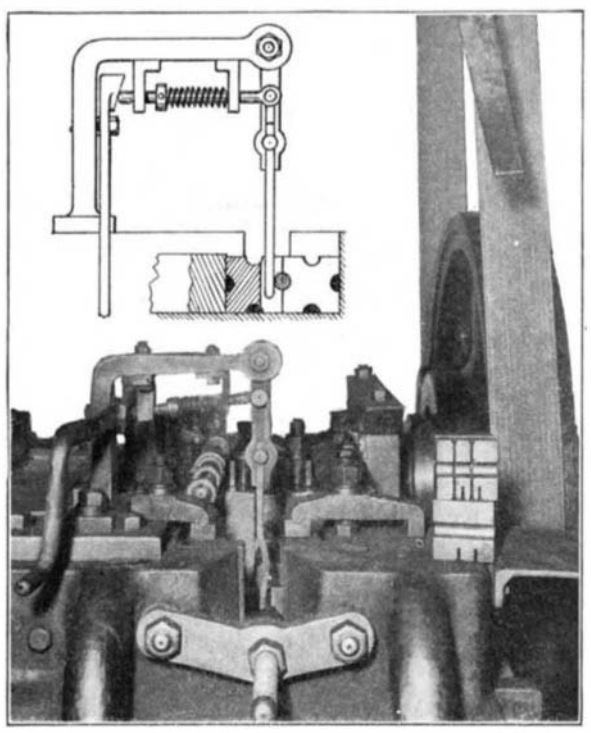


SOLAR MOTOR.

construction. Pivotally mounted at the left end of the base frame is a tower formed with two guide rails, on which a slide block is adapted to travel. The block is raised or lowered to the desired position by means of a rope attached thereto, which passes over a sheave wheel at the top of the tower, and is wound up on a drum at the base. The block supports one end of a tubular shaft, which at the opposite end is supported in a swivel bearing carried on a bracket fastened to the base frame. The reflector is mounted on this shaft by means of a pair of segmental racks, secured to the reflector and adapted to mesh with suitable gearing carried in blocks on the shaft. The shaft at the center opens into a spherical boiler at the focus of the reflector. Steam generated in the boiler is conducted by a pipe passing through the tubular shaft to an engine shown at the extreme right in the engraving. The tubular shaft carries a sprocket wheel, which has chain connection with gearing operated by a clock mechanism on the base frame. The clock train is driven by a weight suspended from the pulley at the top of the tower, and at intervals of two minutes it releases the reflector, which thereupon is rotated through a small angle by a second weight similarly hung. By this means the reflector is made to always bear the proper relation to the sun, so as to focus the sun's rays on the boiler. The vertical movement or inclination of the reflector is attained by operating the gearing which meshes with the segmental racks on the reflector.

ATTACHMENT FOR BOLT-HEADING MACHINES.

A useful attachment for bolt-heading or upsetting machines is shown in the accompanying engraving. It is a device for holding the metal blank in place until

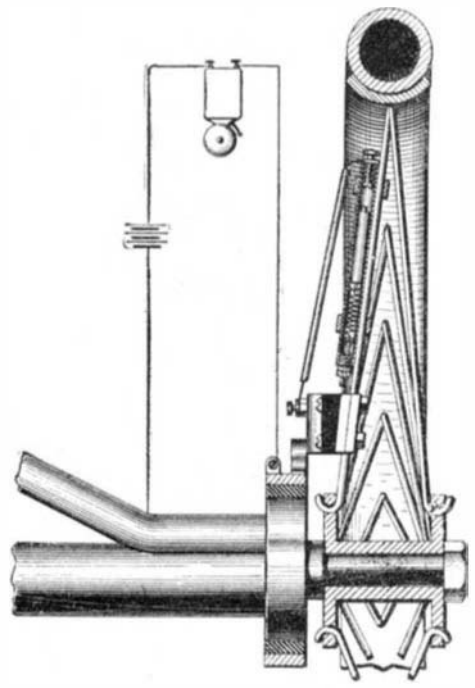


ATTACHMENT FOR BOLT-HEADING MACHINES.

the movable die is moved up to the work, thus permitting the operation to be much more rapidly performed than usual. The attachment comprises a bracket secured to the bed-plate of the machine, and which carries a supporting bar suspended over the dies. Secured to this bar is a finger adapted, when in operation, to hold the work in a fixed die. Mounted in hangers on the main bracket is a spring-pressed rod, which at its outer end is pivotally connected to the supporting bar. A lever mounted on the main bracket carries at its upper end an inclined or cam surface, which bears against the spring-pressed rod. In operation the blank on which the head is to be formed is placed from the front in the channel of the fixed die, and then the cam lever is operated either by hand or foot power to move the spring-pressed rod, so that it will swing the finger into engagement with the work. While so held, the movable die is closed by the machine, and then the heading and upsetting operation is done. As the movable die moves toward the fixed die, a slot in the former will receive the lower portion of the finger. After the operation on the blank, the movable die moves back, enabling the work to drop out, which, of course, relieves the pressure from the finger upon releasing the cam lever. Any length of bolt or rivet may be formed in a machine provided with this device by employing an adjustable abutment in the form of a screw, with the inner end passing into the die to engage with the end of the work. It will be evident that with this attachment work may not only be turned out rapidly, but there will be no waste material, as all short pieces can be used up in short work. Mr. Joseph Skelton, 413 King Street, West Melbourne, Australia, is the inventor of this attachment.

ODDITIES IN INVENTION.

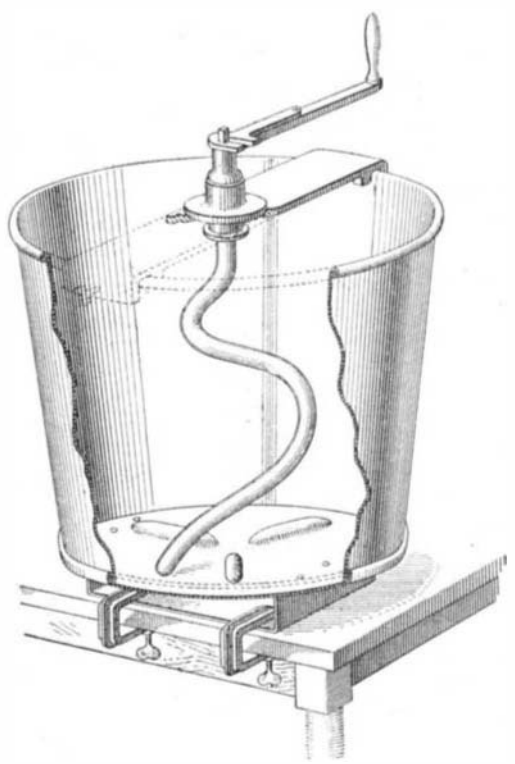
SPEED-INDICATING ALARM.—A device has just been invented for notifying an automobilist, by the ringing of a bell, when his vehicle is exceeding a pre-deter-



SPEED-INDICATING ALARM.

mined speed limit, such, for instance, as the maximum limit fixed by law. It consists of a tube secured to the wheel of the vehicle and carrying a sliding weight therein, normally held against the inner end of the tube by a coil spring. When the wheel is in motion, the weight is thrown outward by centrifugal action, a distance varying with the speed of the wheel. When the speed limit is reached, the weight is thrown far enough to engage and make electrical contact with a screw held in an insulating block in the outer end of the tube. This screw connects with a contact piece on the wheel which, at each revolution, engages a stationary contact on the vehicle frame. The circuit is thus completed to an electric bell, or an electric lamp if desired, to draw the attention of the automobilist. The tension of the spring may be adjusted to provide for any speed limit desired.

BREAD MIXER AND KNEADER.—A Connecticut inventor has just received a patent on the improved bread kneader which we illustrate herewith. It comprises a vessel, formed with a clamp-receiving socket underneath its bottom, by which it may be permanently secured to a table or the like. At the top of the vessel is a detachable crosspiece, in which the operating crank of the machine is journaled. Depending from this crank is the beater, composed of a rod, bent to the form indicated. When the beater revolves through the mass of dough in the vessel, the dough is rolled over and over by the beater. If, however, the dough is too stiff to stick to the bottom of the vessel, it will be carried round and round without any rolling action. To prevent this the inventor has formed a number of fin-

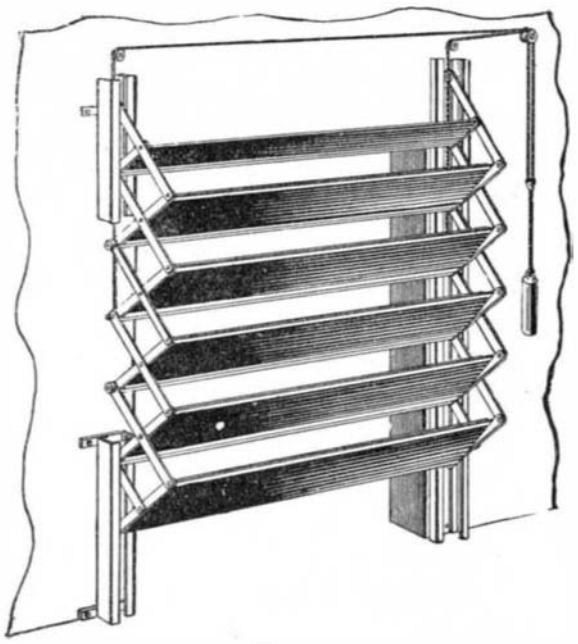


BREAD AND DOUGH MIXER.

gers in the bottom of the vessel, which impede sliding movement of the dough, and insure being rolled by the beater.

FOLDING DOOR.—The accompanying illustration shows an improved folding door, which operates somewhat on the lazy-tongs principle. It comprises a series

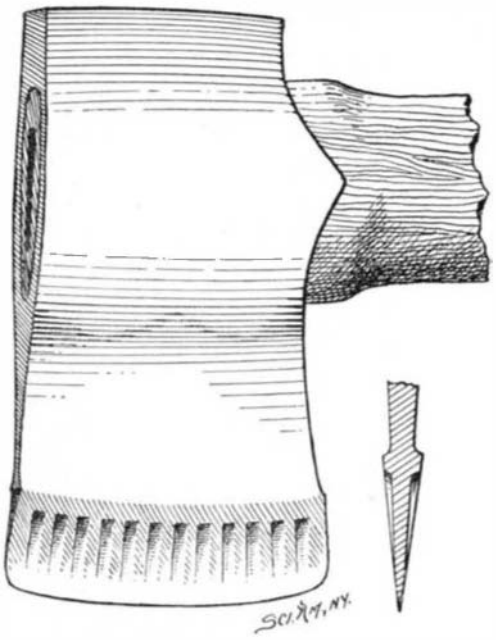
of door sections, which are secured at their outer ends to a series of bars joined to form lazy-tongs. The upper members of the lazy-tongs are pivoted on fixed pins, and the inner joints of the lazy-tongs carry rollers, which engage grooves in the vertical guide pieces



FOLDING DOOR.

provided at each side of the door frame. The guide pieces at one side are broken away, in the illustration, to show detail. A counterweight is secured to a couple of cords, which pass over pulleys at the top of the door frame and are attached to opposite sides of the folding door near the center. The travel of the counterweight, it will be evident, amounts to one-half of the travel of the lowest door section, due to the multiplying motion of the lazy-tongs. A person may thus, by a short pull on the counterweight, raise the door to its full open position.

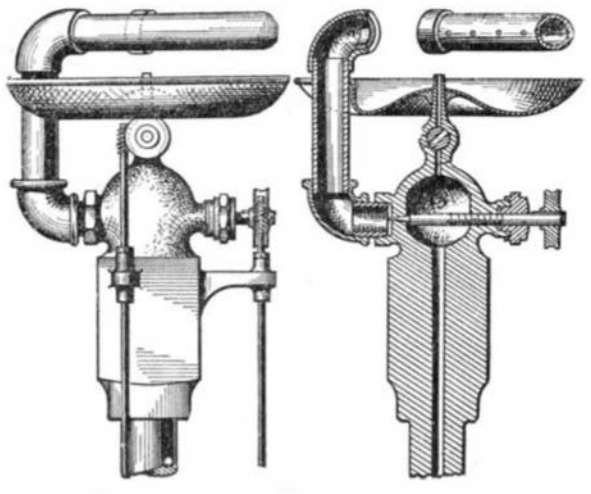
AX HEAD.—A Pennsylvanian has recently devised a new type of ax head adapted to reduce friction between the ax and the wood, by reducing the bearing surface



NOVEL AX-HEAD.

of the ax to a minimum. A series of grooves or recesses are cut in the face of the ax close to the cutting edge and back of these grooves the face is hollowed out as indicated in the accompanying illustration.

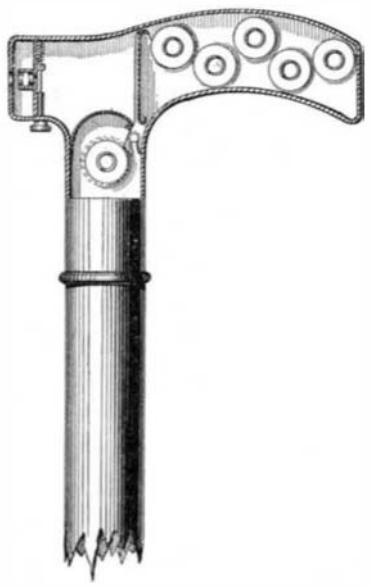
FLASH-LAMP.—We show herewith a convenient type of flash-lamp arranged for producing light by the burning of chemicals. From the sectional view it will be seen that the lamp comprises a burner head,



FLASH LAMP.

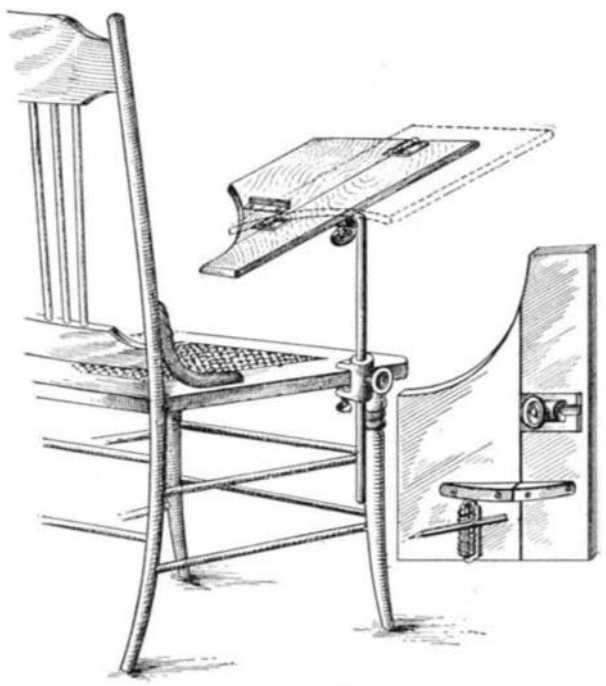
consisting of a central chamber provided with two valved ports, one leading up to a nozzle which projects centrally through a pan at the top of the lamp, and the other to a coil of pipe lying above this pan. The coil is provided with a series of openings on its underside, through which the chemicals may pass out onto the pan. In operation the chemicals, which are supplied to the central chamber of the lamp, may, by proper manipulation of the valves, be permitted to pass up either through the nozzle, or through the coil, where they will be ignited. In the latter case a ring of flame will be produced above the pan. For the purpose of adjusting the valves when the lamp is supported above the reach of the hand, operating rods are provided which have worm gear connections with the valve stems.

CANE-HANDLE CAMERA.—A German inventor has recently produced a magazine camera, which is contained within the handle of a cane. Cane-handle cameras were invented a dozen or more years ago, and were designed especially for travelers. However, they proved impracticable, owing to the fact that but a small supply of plates or films could be carried at a time in the cane. The camera illustrated uses rolls of films, a number of which may be stored in the hollow crook of the handle. The film passes from its roller in the magazine over a plate, which guides it in the focal plane for exposure, and thence it is taken up on the receiving spool in a chamber below. When the entire film has been exposed upon the receiving spool, the side face of the cane handle is removed. The exposed film roll is then taken out, and a new one moved to position for use immediately back of the guide plate.



CANE-HANDLE CAMERA.

BOOK-SUPPORT.—The number of patents on book-supports does not seem to diminish. We show herewith one of the latest inventions in this line. It comprises



BOOK-SUPPORT.

two leaves, hinged together, one of which is secured to an adjustable standard. The other leaf carries a stop piece, against which a book may be supported. When desired, the occupant of the chair may push his book or writing material on to the relatively stationary leaf, and then fold over the movable leaf thereon, so that his work will always be handy when the occupant resumes his seat. The book-stop on the movable leaf causes a space to be formed between the leaves when the book-support is folded. The book-support is provided with the usual vertical and angle adjusting devices, and is secured to the chair by a clamp.

Brief Notes Concerning Patents.

Charles Cranston, of Brooklyn, the inventor of the first under-cutting paper machine used in the United States, died recently at his home in Brooklyn. He was also the inventor of numerous other features of paper machinery, and for thirty years has been the head of a machine plant at Williamsburg. During the war of the rebellion, he was closely associated with President Lincoln and for some time was the chief engineer of the President's yacht. He entertained such pronounced views on the subject of slavery that he narrowly escaped lynching at the hands of a mob during the excitement following the John Brown raids.

Steel fishing rods have been brought to such a state of perfection that they are now being sold extensively in the place of those of bamboo. It is said that they are handier to carry and are better balanced and can be weighted to suit the most fastidious taste. These rods are made of the finest tempered steel tubing, japanned. The eyelets are of German silver wired to the rod. The handle is of cork, the same as used on the wooden rods, but the joints are much superior to those of the bamboo, as the smaller section sinks three inches into the larger one, which makes it practically impossible for the rod to become disjointed when bent in use. It is said that the steel rod is much more sensitive than the wooden one and that every movement of the fish can be felt by the angler.

A patent has been recently issued to A. B. Hunkins, of Winona, Minn., for an improvement in the manner of printing the name and address on newspapers which are to be sent through the mail. The device is to be attached to the perfecting press, and the name and address of the subscriber is printed at the same time that the paper is impressed. The printing wheel by which the impression is made is moved intermittently instead of continuously, as does the cylinder of a press. The new invention makes use of the linotypes made by the typesetting machines which are in general use in all parts of this country. It automatically takes one of these bars of metal from the storage galleys, inserts it in the printing wheel, and after the printing operation is completed, returns the line to the galley. It requires the attention of but one operator, who sets the galleys on the machine and removes them after use. The capacity of this machine is 24,000 separate addresses per hour.

All of the electrocutions which have taken place in the State of New York have been under the active management of Electrician E. F. Davis, who installed the chair and who owns the patents covering the device. These functions have been absolutely dependent on the gentleman's presence; and as the time for one of these affairs approached, there was always a fear that Mr. Davis would fail to be present. He has officiated at the electrocution of over seventy murderers. Two years ago the Legislature of the State appropriated $10,000 with which to purchase the machine and the patent rights, but at that time the inventor refused to sell. Since then, however, Mr. Davis has reconsidered, under the persuasion of Superintendent Collins, and has agreed to accept the sum. The last appropriation having gone by default, it is now necessary to make a new one, and the next session of the Legislature will be asked to do this.

The tower portion of the Madison Square Garden is being remodeled at a cost of $10,000, for the purpose of affording increased laboratory facilities for Cooper Hewitt, son of the late Abram S. Hewitt and the inventor of the system of electric lighting which bears his name. Mr. Hewitt has had his workshops in the tower of the Garden for some time, and it was there that the Cooper Hewitt lamp was developed. The inventor now occupies the first, sixth, and seventh floors, and the improvements which have begun will give him the use of the remaining part of the tower. The alterations call for the entire remodeling of the tower. Additional floors will be put in, and the windows, which are now entirely ornamental, will be supplied with plate glass. The spiral staircase leading to the observation floor will be changed, and fireproof partitions will be erected. The Cooper Hewitt lamp is now largely used for the illumination of photographic studios and shop windows.

For years the planter and the spinner have been united in the hope that some one would invent a "roller" gin that would do the work, while ginners of cotton have recently been eager to get hold of some power capable of making a commercial or "compressed" bale in the ginhouse. It is universally admitted that the saw-gin is almost, if not quite, as barbaric a despoiler in the separation of the cotton fiber from the seed as is the "compress" in forming the bale that is now bought and sold on the exchanges and shipped to the factories of the world. It is contended that the saw-gin actually wastes or destroys over 6 per cent of all the cotton raised in the Southern States. That meant this year the destruction of at least $50,000,000 worth of property belonging to the farmers of the South. Again, it is claimed that by maltreatment and rough handling the saw-gin deprives the cotton fiber of 40 per cent of its tensile strength. Mr. Edward Atkinson says that under present conditions fully 75 per cent of the fiber's initial strength is destroyed.—Thomas Grasty in Southern Farm Magazine.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

BEEHIVE.—C. LUDLOFF, San Pedro de los Pinos, D. F., Mexico. This beehive is particularly adapted for use in places where there are sudden changes of temperature, as in the high tablelands of Mexico, where hot days are followed by cold nights. Such conditions cause the loss of bee swarms every year by springdwindling if the bees are kept in hives of the construction which allows the sudden changes of the outer temperature to influence the life of the bees in their habitations.

STACKER.—L. A. LAMBORN, Scottsville, Kan. Mr. Lamborn's invention relates to a stacking apparatus adapted more particularly for the handling of bundled grain. The stacker is simple, portable and effective in operation, and may be successfully operated by one attendant at the power mechanism, this person also varying the inclination of the carrier frame, and another to manipulate the chute.

Of General Interest.

PHOTOGRAPHIC CAMERA.—M. NIÉLL, New York, N. Y. In this case the invention relates to improvements in cameras, an object being to provide a camera of novel form and construction and of a size to be readily carried in a vest-pocket. A further object is to provide a novel film-strip holder, with means for operating the same to move the strip, whereby new or unexposed surfaces are brought to exposure position.

PROCESS OF MANUFACTURING ARTIFICIAL STONE FROM MAGNESIT.—C. GROSEN, Bonn, Germany. This invention has reference to a process of manufacturing artificial stone from oxychlorid of magnesium, and it is distinguished from the processes heretofore in use by providing means whereby the sweating and efflorescence and the subsequent cracking of the stones as heretofore manufactured is avoided and the stones are given an increased hardness.

TOY BANK.—A. FONTS, New York, N. Y. In carrying out the present invention Mr. Fonts has particularly in view the provision of an article such as toy banks, safes, or the like, the parts of which are so correlated and arranged that when once a coin has been deposited in the bank it will be impossible to remove the same without a door provided for the purpose or destroying the bank.

INDICATOR-CHART FOR BUSINESS EXCHANGES.—A. J. DELAVIGNE, New Orleans, La. The improvements in this case have reference more especially to charts or boards for use by companies or exchanges engaged in buying and selling—say grain, cotton, or oil, for instance; and the principal object is to provide means for visually indicating both buyers and sellers of goods, which particular offer for the purchase or sale may be accepted by each buyer or seller and also to provide a board whereby business may be transacted between buyers and sellers even if one of the two parties should be absent and also arranged and operated so that none but the closers will know by whom the offers are made.

ENVELOP AND LETTER-SHEET FOR SAME.—G. ARCHIBALD, New Rochelle, N. Y. The inventor's purpose is to provide a construction of an envelop and a letter or bill sheet especially adapted thereto which will admit of a folding stub forming a portion of the letter or sheet after having been addressed on one or both sides to be passed through openings in the envelop when the letter or bill is placed therein and the stub be secured at the outer face of the envelop in a manner to disclose an address, rendering it unnecessary to write or print the address on the envelop.

PUZZLE.—E. G. JACKSON, San Francisco, Cal. In this puzzle a series of slides are positioned upon a frame with their Roman numerals in irregular order, and they may then be rearranged in consecutive order by releasing, say, "V" and "X" by certain means, then releasing "VI" and "VIII" by certain means. Without disengaging more than one end of each slide at a time these may be brought into the desired order. Considerable ingenuity may be involved in accomplishing the purpose of this entertaining device.

METAL DAM.—J. L. HOLMES, Butte, Mont. The object of the improvement is to provide a dam more especially designed for use in canyons, streams, and other waterways having steep or slanting banks, which dam can be readily set up, is exceedingly strong and durable, and is arranged to dispense almost entirely with the use of masonry and to allow of building the dam without seriously interfering with the natural flow of water in the waterway.

POST-CHECK CURRENCY. I. D. WORCESTER, Pittsburg, Pa. This invention relates to that class of currency or money which is designed to be changed by the holder thereof into a check payable only to the payee named thereon. The objects of the post-check currency as now contemplated are not accomplished, and the system is without practical efficiency in its present condition. It is necessary to devise some simple means which renders the post-check note after it has been once transformed by the holder into a check payable to the payee named thereon recognizable at a glance and absolutely incapable of being again transformed into a close resemblance of the unchanged post-check note. Mr. Worcester accomplishes this object.

BOTTLE.—R. G. DAVIS, Hot Springs, Ark. This bottle is so constructed that after discharge of its original contents it cannot be refilled. The bottle is provided with a valve which leaves its seat to allow the liquid to pass freely out. Should an attempt be made to refill the bottle by placing it in liquid or by forming a vacuum in the bottle and then inserting it in liquid, the liquid will force the valve tightly against its seat, and thus prevent refilling.

CLOSURE FOR AIR-SHAFTS.—M. SCHOLL and D. GRONFELD, New York, N. Y. The principal object of the invention is to provide an improved apparatus whereby air shafts in buildings may be automatically divided into sections corresponding to the floors of the building, whenever fire enters the airshaft to any considerable extent. The invention also provides means at each floor for automatically closing the air-shaft at that point, when desired.

GARMENT-CLASP.—J. P. WILSON, Chicago, Ill. The invention relates to clasps that afford gripping ends for garment or hose supporters and has for its object to provide novel details of construction for a garment clasp that adapt it for a very reliable engagement with the garment, avoid injury to the most delicate fabric, and permit a quick and convenient release of the material engaged by the clasp.

PERPETUAL CALENDAR.—T. O'SHAUGHNESSY, San Jose, Cal. The purpose of the invention is to provide a simple and accurate form of perpetual calendar that may be set for any month in any year, leap year included, and in any century within the scope of the calendar, and the day of week of any date may be quickly and readily ascertained without calculation on the part of the operator.

TRIGONOMETRICAL METER.—H. C. PERCY, Natchitoches, La. This meter is designed for use by surveyors in the field for finding, without calculation, the distance to any remote object, or the height of an object. It is also serviceable in schools for the clearer teaching of trigonometrical functions, since it shows for any angle the just proportions between the different lines within and without the circle to the radius.

COUPLING. F. J. CARNEY, New York, N. Y. Mr. Carney's invention relates to couplings adapted more particularly for use in connecting the piping of such receptacles as set urinals. Its principal objects are to provide a device of this class which may be readily applied and removed and which will preserve the integrity of the joint.

WHIRLING TOY.—S. BRISTOW, Topeka, Kan. The toy consists of a cone-shaped body, provided with vanes around its base edge, and attached by a cord to a rod. When the toy is held in the wind, it will be forced outward by the wind which impinges against the vanes, causing the toy to rapidly rotate.

SEPARABLE HINGE.—S. F. MEEK, New York, N. Y. The primary object of Mr. Meek's invention is the provision of a simple and cheap construction, wherein one of the two leaves of a hinge may be quickly connected to or disconnected from the other, without removing the pintle, and at the same time the two leaves remain in engagement under normal conditions in the service of the article. The hinge may be so manipulated as to overcome the practical difficulty met by experienced workmen in hanging a door by ordinary hinges, this difficulty consisting in bringing the hinge leaves on the door simultaneously into engagement with the hinge leaves on the jamb.

TOY.—S. JURADO, New York, N. Y. The purpose of this invention is to provide a toy in which a transparent cylinder is provided having means by which a ball or other rolling object passes and lodges in pockets or passes through openings in any one of a series of disks or rotating receivers mounted to revolve in the cylinder and finally passes out through the base for the cylinder, having apertures therein and a depression arranged around the apertures, which apertures lead to exposed chambers in the base, any one of which may finally receive the ball.

Household Utilities.

BED OR COUCH.—F. W. BOECKER, Oakland, Cal. The object of this invention is to provide a bed, couch, sofa, or the like which may be readily adjusted from the horizontal to any desired inclination. This end the inventor attains by certain novel devices mounted on the bed-frame and having connection with a supplemental or slat frame, which is pivoted on the main frame and which carries the mattress and bedclothes.

EGG-BEATER. W. V. PALEY and T. H. BUSSEY, Charters Towers, Queensland, Australia. In this patent the invention relates to improvements in a culinary device for beating eggs, for beating and mixing compounds for sponge and other cakes, and for beating milk or for any kind of substance. The primary object of the improvement is to produce a simple, convenient, and cheap article for rapidly and easily beating food substances.

WATER-CLOSET BOWL.—M. D. HELFRICH and F. W. KINGSBURY, Evansville, Ind. In this case an object is to provide a construction for washing down the closet without or with siphonic action, to do away with all splashing and agitation of the contents, to avoid noise incident to flushing the ordinary closet, and to provide for flushing from the rim after the contents of the bowl or trap-seal have been discharged.

WATER-CLOSET BOWL.—R. SCHMALMACK, Evansville, Ind. This invention relates to an improvement in wash-down water-closet bowls, its object being to produce a device wherein the flushing-water is divided into two parts, one going to the rim outlet and the other to the bottom outlet. It may be used equally well on wash-down bowls employing siphonic action, as well as these without such action, and materially increases the efficiency of both types of bowls.

FOOT-TUB.—J. A. CALDWELL, Rochester, N. Y. The object in this instance is to provide a tub that may be readily placed in an ordinary or large bath-tub and having a drain-nipple adapted to engage in the bath-tub drain-pipe, thus permitting the running off of water from the foot-tub without danger of any other water passing into the large bath-tub and possibly spoiling the same.

Machines and Mechanical Devices.

DRILLING-MACHINE.—F. F. HEPLER, Crescent City, Cal. Mr. Hepler's invention is in the nature of an improved rock-drilling machine of that type in which a set of rotating hammers are made to act upon the end of the drill-bit and the latter is turned and also in which means are provided for forcing a continuous stream of water into the drill-hole beside the drill-bit to soften the rock and to clear out the cuttings, so that the operation may be continuous.

BRICK-REPRESSING MACHINE.—C. W. PUGH, Veedersburg, Ind. It is the object of this improvement to provide a machine which is adapted for automatically repressing bricks with great rapidity and economy of time and labor. The bricks are received upon a traveling feed-belt and carried forward to dies by which they are repressed and then automatically discharged and deposited upon a conveyor by which they are removed from the repressing machine.

APPARATUS FOR FORMING THREADS ON GLASS.—F. WACKENHUTH, New York, N. Y. This apparatus is intended for forming screw-threads of any desired pitch and form on glass cylinders, rods, and other round objects. The inventor has discovered that by providing a tool in the form of a disk composed of a homogeneous substance sufficiently hard to cut or grind into the glass, by driving this tool revolubly at a high rate of speed, and by feeding the work against the periphery of the tool he is enabled to form a thread of any desired sort around the surface of the work.

CLOTH-CLEANING BRUSH FOR FLOUR-BOLTING MACHINES.—L. JONES, Columbus, Ohio. One purpose of the invention is to supply each sieve having a cloth with an independent cleaner. Another is to provide each sieve with an automatically-operating brush which derives its impetus from the motions of the sieve-box, the same being propelled backward and forward by the arrangement of its mechanism so as to subject the entire surface of the bolting-silk to the continual action of a brush or brushes, which brushes many be sustained in position by bolts and springs or other suitable devices.

BASKET-MACHINE.—C. ENBERG, St. Joseph, Mich. The invention relates to basket-machines, the object of Mr. Enberg's several improvements being to render the machine, as far as practicable, automatic and to present certain points of advantage. This machine has been tried in actual practice, and it is found that the two hand-levers are quite adequate to handle it, thereby making its action to a great extent automatic.

SLACK-THREAD CONTROLLER FOR SEWING-MACHINES.—H. MANNING, 1a Foster Lane, London, England. This invention relates to the lock-stitch sewing-machine described in an application for a prior United States patent, in which all the movements are derived from only three cams and practically the entire operative mechanism is situated beneath the work-plate. The present invention relates to an improved take-up device for the thread.

BARREL SOAKING AND RINSING MACHINE.—H. REININGER, New Orleans, La. In this case the invention refers to washing apparatus; and its object is to provide a machine arranged to subject the exterior and the interior of a barrel or like package to the action of hot or cold water for soaking the package and thoroughly cleansing and rinsing the same in a comparatively short time and without the aid of skilled labor.

STONE-SAWING MACHINE. J. B. HANLEY, New York, N. Y. In this patent the object of the invention is the provision of a new and improved stone-sawing machine arranged for making straight or curved cuts in the stone block to cut the latter to any desired shape. The invention consists of novel features and is intended to efficiently serve the purpose for which it is designed.

TUBE-WELDING MACHINE.—W. BYRD, Winnipeg, Canada. Mr. Byrd's improvement has reference to a machine which upon changing the tools thereof may be employed either for cutting tubing or for welding together two sections of the same. It belongs to that class in which the tube to be welded is placed over a mandrel and welding tools are driven around the outer surface of the tube at the point of the weld.

VISE.—C. H. RITTS, Wausa, Neb. In this patent the improvement relates to a class wherein the jaws of the vise are closed by foot-pressure, and has for its object to provide novel details of construction for a vise of the character indicated which adapt it to grip and hold articles very firmly and permit their release by slight manual effort.

Prime Movers and Their Accessories.

STEAM-TRAP.—R. D. TACKABERRY, Lewiston, Me. The invention provides a novel manner of mounting one element of the means for transmitting movement of the float so that this element may be readily and fully adjusted from the exterior of the trap, thus regulating the level to which the water is allowed to rise. A novel diaphragm is also provided for operating the outlet valve, this arrangement avoiding the use of the stuffing box and the friction incident thereto.

COOLING AND LUBRICATING CRANK-CASE ENGINES.—R. L. BOWMAN, Pineville, Ky. In crank-case steam engines of the usual type great difficulty has been experienced in keeping the bearings cool and properly lubricated. The present invention provides a novel process and apparatus for cooling and lubricating the bearings, in which the crank-case is never allowed to reach a high temperature and the oil is neither emulsified nor cooked, but is constantly removed in normal condition from the crank-case as it accumulates, and is separated by gravity and used over and over again,

LUBRICATOR.—E. CLARK. Winslow, Arizona. Mr. Clark's invention is an improvement in lubricators especially designed for use in connection with the relief valve of a locomotive steam chest for the purpose of feeding graphite or other lubricant into the valves or cylinders of the locomotive, while the latter is drifting with the steam shut off.

COOLING MECHANISM FOR EXPLOSIVE-ENGINES.—F. REAUGH, Oak Cliff, Texas. This invention relates to a means for air-cooling cylinders of internal-combustion engines and other machinery. The leading feature is the formation in or on the cylinder walls of an air passage or passages and in so arranging parts that movement of piston brings a circulation of air through this passage, such circulation extending into interior of cylinder to cool piston as well. Preferably, and especially in case of adaptation to internal-combustion engines, the engine balance-wheel is formed with fan-blades. These act at mouth of air-passage to accelerate air current and assist action of piston with respect to such contents. Compared with other systems now used, this mechanism, owing to positiveness and thoroughness of air circulation, must give much greater efficiency.

Railways and Their Accessories.

METAL CROSS-TIE AND RAIL-FASTENER. B. S. SAWYER, El Paso, Texas, and C. C. BULL, Albuquerque, New Mex. The object in this case is to provide details of construction for a plate-metal cross-tie and track-rail-fastening means that engage the tie, whereby the cross-tie is afforded means that adapt it for the support of a heavy weight, although a limited area and weight of plate metal is used in its construction; and the track-rails are held secured on said cross-tie in a reliable manner, which permits removal of the track-rails as occasion requires. A further object is to so construct the fastening means that rails of different weights and thickness of rail-bases may be clamped upon the improved cross-tie.

COMBINED CHECK-HOLDER AND MATCH PLATE.—M. J. BEVANS, New York, N. Y. The invention of Mr. Bevans relates to a combinational device capable of use both as a check-holder and as a match-plate. His invention also consists of certain improvements in the device considered as a "check-holder." The device enables a passenger to remain undisturbed in regard to care of check and free to read or conduct himself in any way desired. The match-plate is mounted very conveniently for his purposes.

Pertaining to Vehicles.

COMPOUND VEHICLE-WHEEL.—F. M. OLIVER, Oswego, N. Y. The object of the inventor is to provide details of construction for a wheel for use on railroad-cars, traction-engines, automobiles, road-wagons, or vehicles designed to travel over uneven roads or be moved over soft ground on a road or in a field and which in service will minimize the power required to propel or draw the vehicle, and furthermore, to render the movement smooth and adapt it to maintain an upright position traveling over a rough or inclined road-bed.

PROTECTOR FOR PNEUMATIC TIRES.—J. F. BURNAM, Madison Station, Ala. Dr. Burnam's invention belongs to the class of protectors for elastic wheel tires of automobiles, bicycles, and other vehicles, which are adapted for application to the tread of such tires without inclosing the body of the same, and whose purpose is to prolong the life of the tire by taking most of the friction and wear incident to use.

NOTE. Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of the paper.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.

Inquiry No. 6137.—For manufacturers of machines for making mandolin and guitar bass strings.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6138.—For the present address of the Tower Coupler Co.

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6139.—For parties handling mail order novelties.

WANTED.—Address of the makers of latest machines for curling hair for upholstery purposes. C. Nolan & Sons, Devonshire Street, Cork, Ireland.

Inquiry No. 6140.—For an apparatus for quickly determining the intrinsic value of various coals.

FOR SALE.—Patent on wood split pulley can be bought at a bargain. There is none better manufactured. Address F. J. Ranford, 22 State St., Seneca Falls.

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Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(9472) M. K. says: I take the liberty of addressing you in view of securing the following information, for which I thank you in advance. Kindly tell me how the field of an alternating-current motor, of the Westinghouse type, is wound. A. There are many forms of alternating-current motors made by the Westinghouse Company, the windings of which differ from each other. Each one is wound after its kind. If you apply to the Westinghouse Company, they will doubtless be willing to explain to you any particular type in which you may be interested. In general, it may be said that the polyphase motor does not resemble a dynamo in its windings as closely as does the direct-current motor. Polyphase motors have a stationary and a rotating part; the stationary part is called a *stator*, and the rotating part is called a *rotor*. The stator in most motors has sets of coils in which the polyphase currents produce a rotary field. The rotor has closed coils in which the field produces closed currents, with the result that a torque or pulling force is produced, which causes the rotor to turn around, following the pull of the rotary field. The coils of the rotor may be copper bars imbedded in slits of the laminated steel or iron core. These bars are connected to copper collars at the ends of the rotors. Such an arrangement is called a *squirrel cage* rotor, or armature. See Sheldon's "Alternating Current Machines," price $2.50.

(9473) E. H. A. asks: Would not an expanding jet of steam travel slower at its expanded end than at its issuing end? If so, is it not paradoxical or illogical to enlarge the compound end of the Parsons steam turbine, so as to cause the blades at that end to revolve at a higher speed than the first sections of buckets getting the liveliest steam? A. The velocity of steam in an expanding nozzle varies adiabatically and inversely with the increasing area of the nozzle. Its expansion in the inverted cone does not increase its velocity, but does increase its area of impact on the blades of the turbine, and so balances the loss of velocity. The velocity of steam issuing from a nozzle to the atmosphere at 100 pounds pressure is 898 feet per second; while if issuing into a vacuum from the same pressure it is 1,700 feet per second, which suggests the enlarged terminal sections of the steam turbine as a condensing engine.

(9474) R. G. B. asks: 1. Is there any constant relation between watts and foot pounds per second? 550 foot pounds per second equals 1 horse power. 746 watts equals 1 horse power. Can foot pounds be calculated in watts, and *vice versa*? A. You say "550 foot pounds per second equals 1 horse power, and 746 watts equals 1 horse power." Since things which are equal to the same thing are, in the same sense, equal to each other, why do you not say, 550 foot pounds per second equals 746 watts? 746 watts will in 1 second exert a horse power in a motor, and will continue to do so as long as the motor runs. Watts and foot pounds are interchangeable as given above. 2. How can the horse power of a single-cylinder, vertical, two-cycle, gasoline engine be determined, when the apparatus necessary for calculating the brake horse power is not at hand? A. There are but two reliable methods of testing the power of a gasoline engine. First, the indicated power as registered on a card by an indicator, from which the mean pressure may be measured and the indicated horse-power computed. Second, the actual or brake horse-power taken by a Prony or any other form of brake. The difference between the indicated and brake horse-power is the power lost by the friction of the engine. Third, a method based on the heat units of the fuel fed to the engine in a given time, from which must be deducted the heat units carried off in the exhaust by the cooling water, and by radiation, leaving a balance assignable to indicated power. Still another method of determining the power is the Renard dynamometric fan described in SUPPLEMENT, No. 1460.

(9475) H. H. C. asks: Will you kindly answer me in the Notes and Queries column of the SCIENTIFIC AMERICAN the following question: I find that when the street-car tracks are connected with a direct line to the dynamo, a current of about twenty volts and high amperage results. When the car is at the place tapped, the voltage is highest, and diminishes as the car proceeds from that point; also when the car stops the current stops, thus causing a current which is not continual. Will passing the current through a storage battery, or some other receptacle, produce a continual current between the "governor" and dynamo? A. You say you find a drop of voltage of twenty when a wire is taken from a street rail direct to the dynamo, which is highest when the car is at the place tapped. The voltage is then highest because the resistance in ohms is less from the trolley wire to the dynamo. As the car goes away further from the dynamo, the resistance increases from the trolley to the dynamo, and thus the drop of voltage from the place tapped to the dynamo is less. There are the same volts all the time from the plus wire to the dynamo, except for the drop between the dynamo and the trolley along the plus wire, which is usually the upper wire, on which the trolley bears. When the car stops, current is shut off, and of course none shows on the wire you have cut in between the rail and the dynamo. Passing the current through a storage battery will not help the current. If a storage battery is charged from the return current of a trolley line, that battery can be afterward used.

NEW BOOKS, ETC.

HANDBOOK OF GASOLINE AUTOMOBILES. Association of Licensed Automobile Manufacturers. New York. 1904. Pp. 83.

It is seldom that we review a catalogue, but in the present instance it is merited, as it illustrates all the principal types of automobiles which are manufactured and imported under the license of the Association of Licensed Automobile Manufacturers, under the basic patent granted to George B. Selden. The catalogue is beautifully gotten up, and shows a very large number of types of machines. It is an admirable book of reference, and should be in the possession of all who are interested in automobiling.

GOLD ASSAYING. By H. Joshua Phillips. New York: D. Van Nostrand Company, 1904. 8vo.; pp. 138. Price, $2.50.

This work is a practical handbook for the use of chemists and assayists. It contains, besides opening chapters on the natural appearance and forms of gold, its physical characters and chemical properties, and the sampling of gold ore, articles on the assay furnace, cupelation, parting, scorification, the assay of bullion, and assays in cyanidation, chlorination, and amalgamation processes, which are all thoroughly described. A valuable appendix contains much information about the coinage of the different countries, and the amount of gold produced by various well-known mining districts. A very complete index aids in making the book useful.

MODERN ELECTRICITY. By James Henry, M.E., and Karel J. Hora, M.Sc. Chicago: Laird & Lee, 1904. 12mo.; pp. 355; 150 cuts. Price, $1.

This volume is intended as a practical handbook for students, apprentices, and electrical engineers. Besides the principles and formulas governing electricity, which, by the way, are presented in as simple a manner as possible, the book contains many practical examples and their answers, from the study of which much useful knowledge may be obtained. The scope of the book is considerable, dealing as it does in the first place with static electricity and ending with X-rays, wireless telegraphy, and radium. Besides having this wide scope, it also deals with electrical machinery, batteries, wiring, etc., in a very practical manner.

A TEXTBOOK ON CERAMIC CALCULATIONS. By W. Jackson, A.R.C.S. New York: Longmans, Green & Co., 1904. 12mo.; pp. 67. Price, $1.

This book is not a practical work on pottery and porcelain manufacture, but is given up wholly to mathematical calculations and the like, which will be found of use to all students and workers in clay, pottery, and porcelain. Among other things, it treats of the loss of weight of potter's material on drying and firing; of the fitness of ground materials; the calculation of formulæ of compounds from their percentage compositions, and *vice versa*; the compounding of mixtures of definite composition from substances of known chemical composition, and the application of this knowledge to the complete synthesis of mixtures of known formulæ from raw materials of given composition. The rational analysis of clays, and the methods of calculation based upon it, as well as the application of such analysis to the synthesis of bodies, is another of the subjects dealt with.

TALKING MACHINES AND RECORDS. By S. R. Bottone. London: Guilbert Pitman, 1904. 12mo.; pp. 86; 40 illustrations. Price, 60 cents.

This book is the latest addition to the series on electric and scientific subjects from the pen of that well-known experimentalist, Mr. S. R. Bottone. It describes the principles and methods of constructing various sound-reproducing machines, and also gives practical directions for making a simple and efficient phonograph. A brief historical outline of the work of different experimenters, which has led to the perfection of the phonograph, is also included.

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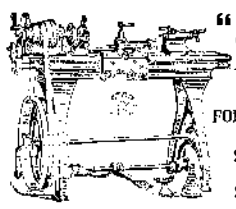

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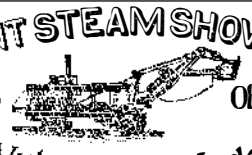
Toledo  Ohio, U.S.A.
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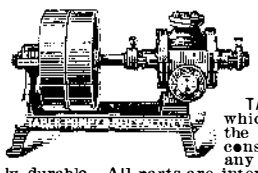

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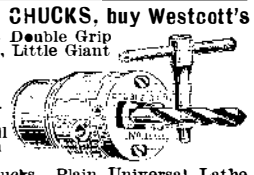

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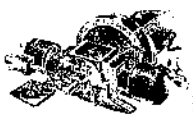

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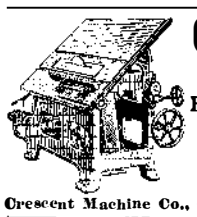

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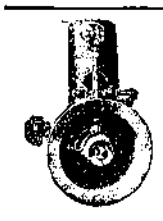

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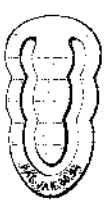

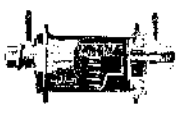

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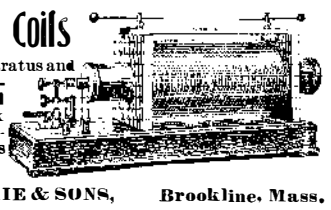

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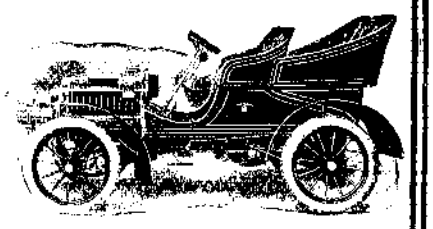

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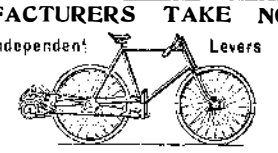

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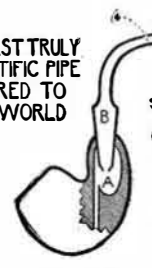

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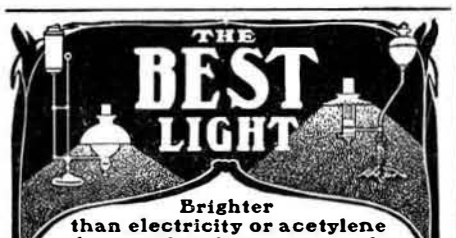

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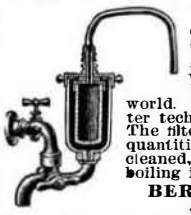

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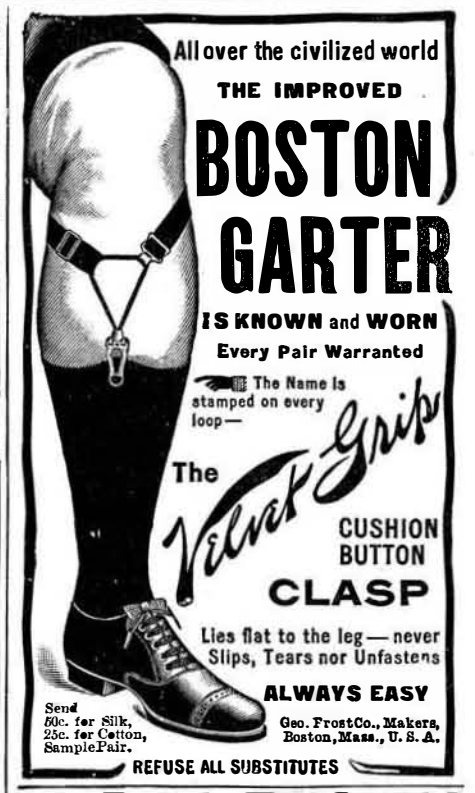
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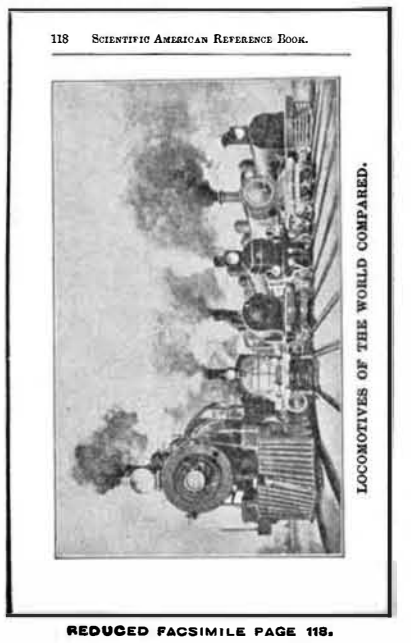

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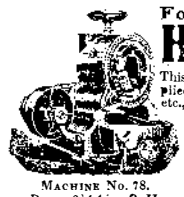

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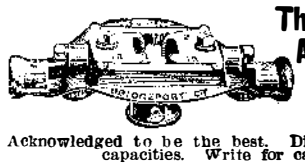

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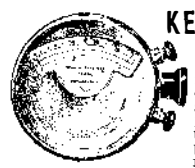

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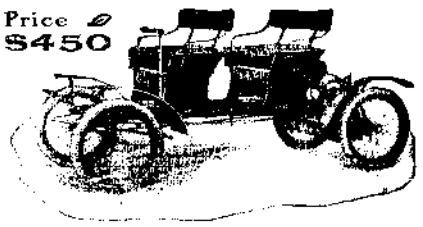

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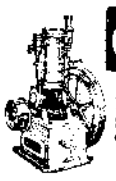

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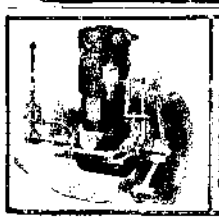

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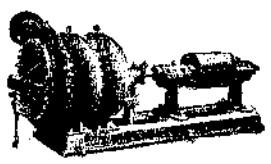

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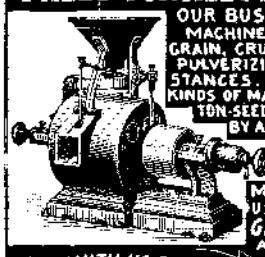

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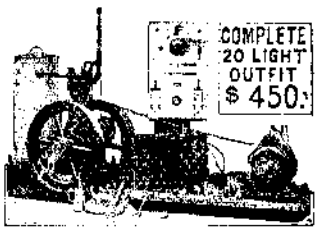

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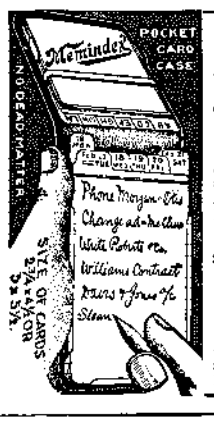

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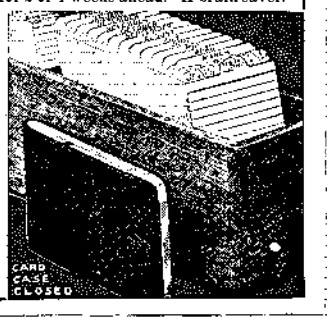

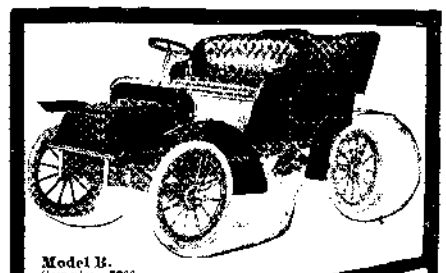

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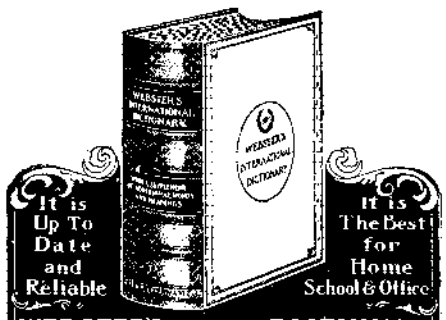

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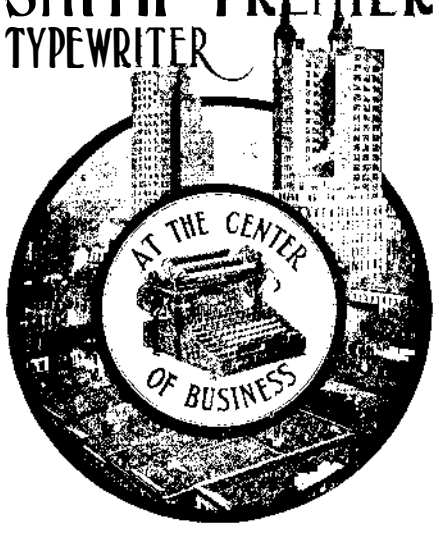

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